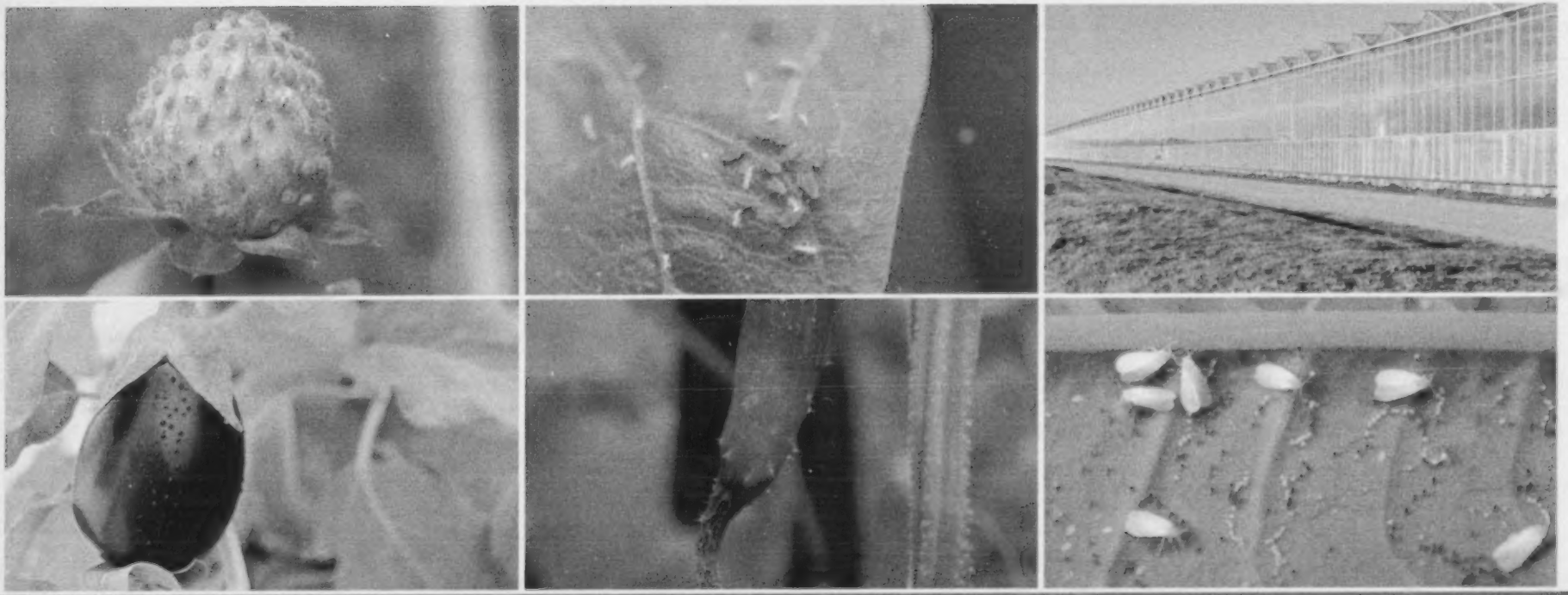
CROP PROTECTION GUIDE FOR
GREENHOUSE VEGETABLES
2016–2017

Publication 835



Ministry of Agriculture,
Food and Rural Affairs

Ontario

Discard old editions of this publication. Each year the appropriate sub-committee of the Ontario Pest Management Research and Services Committee reviews the pesticides listed in this publication. To the best knowledge of the committee, at the time of printing, the pesticide products listed in this publication were:

- **federally registered**
- **classified by the Ministry of the Environment and Climate Change (MOECC)**

The information in this publication is general information only. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) does not offer any warranty or guarantee, nor does it assume any liability for any crop loss, animal loss, health, safety or environmental hazard caused by the use of a pesticide mentioned in this publication.

This publication lists a number of brand names of pesticides. It is neither an endorsement of the product nor a suggestion that similar products are ineffective.

The Pesticide Label

Consult each product label before you use a pesticide. The label provides specific information on how to use the product safely, hazards, restrictions on use, compatibility with other products, the effect of environmental conditions, etc.

The pesticide product label is a legal document. Follow all label directions.

Federal Registration of Pesticide Products

The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticide products for use in Canada following an evaluation of scientific data to ensure that the product has value, and the human health and environmental risks associated with its proposed use are acceptable.

1. **Full Registration**
   Pesticide registrations are normally granted for a period of 5 years, subject to renewal.
2. **Conditional Registration**
   Conditional registration may be granted for a specified, limited time period, where the registrant agrees to produce additional scientific or technical information.
3. **Emergency Registration**
   An emergency registration is a temporary, time-limited registration of no more than 1 year, approved to deal with serious pest outbreaks that have limited control options.

Maximum Residue Limits

The PMRA has established maximum residue limits (MRLs) for pesticides. Processors or retailers may demand more restrictive limits. Growers should seek the advice of their intended market to determine if more restrictive limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

Supplemental Labels

You MUST obtain a supplemental label and follow all the label directions when PMRA approves new uses for a registered pesticide that do not appear on the current label.

Examples of when you must use a supplemental label include:

- **Emergency Use Registration**
- **Minor Use Label Expansion**

You can obtain a copy of a supplemental label from the pesticide manufacturer or pesticide vendor, the grower association that sponsored the emergency registration or minor use, from OMAFRA or from PMRA's Pest Management Information Service.

For more information on the federal registration status, check the PMRA website at www.healthcanada.gc.ca/pmra or call 1-800-267-6315.

Regulation of Pesticides in Ontario

The MOECC is responsible for regulating pesticide sale, use, transportation, storage and disposal in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09.

All pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at ontario.ca/e-laws or by calling ServiceOntario Publications toll-free number: 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

The Ontario Pesticides Advisory Committee (OPAC) is responsible for reviewing and recommending to the MOECC, the classification of pesticide products before they can be sold or used in Ontario. Once approved by the MOECC, classified products are posted on the MOECC website: ontario.ca/pesticides.

Certification and Licensing

Certified Farmers and Their Assistants

For information about certification for growers and training for assistants, check the Ontario Pesticide Education Program website: www.opep.ca or call 1-800-652-8573.

Commercial Applicators (Exterminators) and Their Assisting Technicians

For more information about exterminator licensing and technician training, visit:

- The Ontario Pesticide Training and Certification website at www.ontariopesticide.com or call 1-888-620-9999 or 519-674-1575
- The Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide-technician or call 1-800-265-5656 or e-mail pic@hort-trades.com
- The Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca.

Cette publication est aussi disponible en français.

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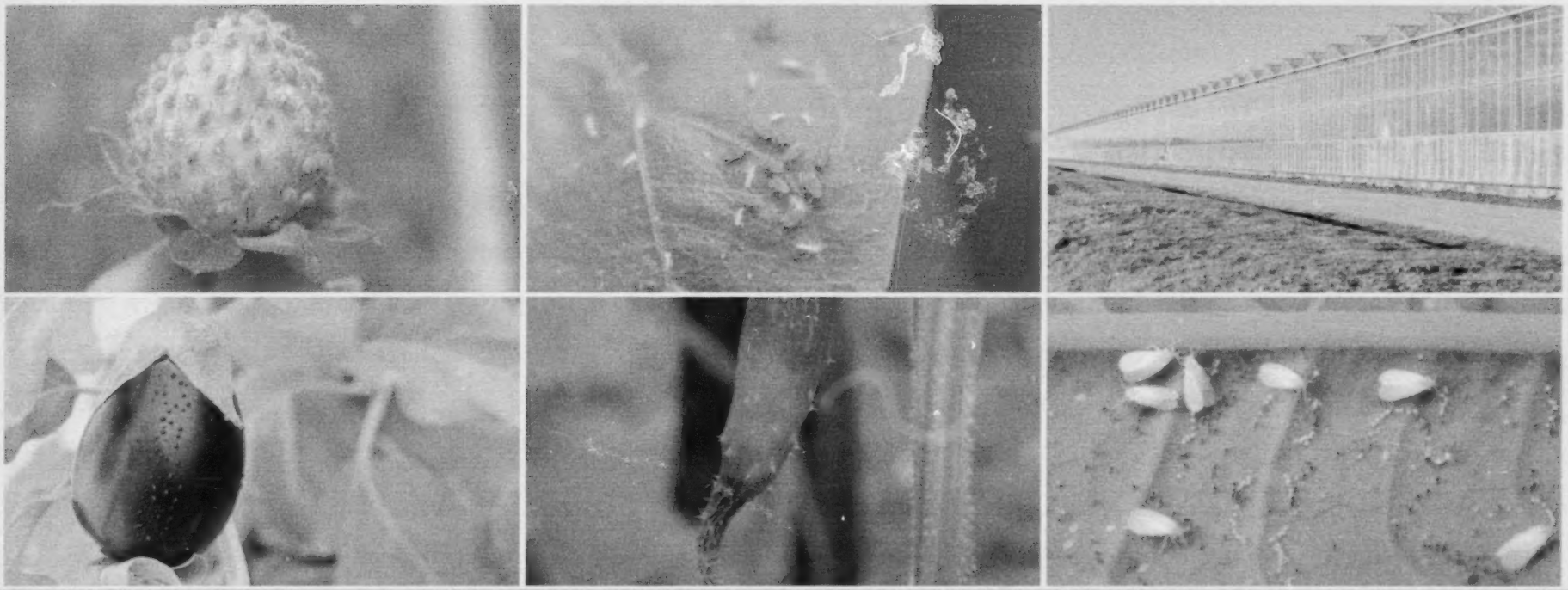

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Acknowledgements

The information contained in this publication has been peer reviewed.

If you need technical and business information, contact the

Agricultural Information Contact Centre at

1-877-424-1300

or ag.info.omafra@ontario.ca

If you are looking for greenhouse production information on the internet, check the OMAFRA website at ontario.ca/crops

This publication contains all pesticide products that have been registered as of May 2016 for use on greenhouse vegetable crops. For more comprehensive information on pest management strategies, pest life histories and diseases, and for information related to production of the major greenhouse vegetables in Ontario, see OMAFRA Publication 836, *Growing Greenhouse Vegetables in Ontario*. Information on ordering OMAFRA publications is found on the inside back cover of this book. Supplements to this publication will be posted to the OMAFRA website.

Cover Images

Front

Top left:	powdery mildew, strawberry
Top middle:	aphids, pepper
Top right:	glasshouse
Bottom left:	eggplant
Bottom middle:	gummy stem blight, cucumber
Bottom right:	whitefly

Back

Top left:	looper, tomato
Top middle:	tomatoes
Top right:	lady beetle eating an aphid
Bottom left:	two-spotted spider mite
Bottom middle:	Botrytis, pepper
Bottom right:	Lygus nymph

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Introduction

Products Listed in This Book

This book lists products that are registered for use on greenhouse vegetables, and contains registrations obtained up to May 2016. Products are listed according to pest for each greenhouse vegetable crop.

Information within the tables is based on labels approved by the Pest Management Regulatory Agency and is included so that growers can consider options when implementing their pest management programs.

When selecting a product to use, growers should consider several factors, including compatibility with beneficial insects, safety to the user, pre-harvest and re-entry intervals and resistance management.

Resistance Management Strategies

Different pesticides control pests in different ways. This is called the mode of action. Pesticides are grouped into chemical families/groups based on their mode of action.

Using the same pesticide with the same mode of action season after season or several times within the same season could result in the target pest becoming resistant to the chemical family.

A pest can develop resistance to one chemical family but still be very susceptible to another. Therefore, to reduce the risk of a pest developing resistance, use the following strategies:

- Avoid repeated use of pesticides from the same chemical subgroup (indicated by the IRAC and FRAC Mode of Action Group number — see Appendix D and Appendix E).

  For insecticides, rotate between chemical groups/families. Use products within one group only for the duration of one generation of the target insect before switching to another group for the following generation.

- Only use pesticides when necessary and integrate them as much as possible with other management strategies in an Integrated Pest Management (IPM) program.

  For example, to manage insect and mite pests, major strategies should include crop monitoring and biological control.

  Cultural controls such as sanitation and mass trapping should also be considered to minimize pesticide use and thereby reduce the risk of a pest developing resistance to a pesticide.

  To manage diseases, major strategies should include sanitation, maintaining optimum levels of moisture and nutrients in the growing media and manipulation of environmental parameters (e.g., relative humidity and temperature) to minimize conditions that favour development of disease. For further details on insect pests, mite pests and diseases, as well as IPM strategies for managing them, see OMAFRA Publication 836, *Growing Greenhouse Vegetables in Ontario.*

- Do not exceed the total number of applications allowed per year for each product. Do not apply the product at rates lower than the recommended rate on the label.
- Monitor recently treated pest populations for signs of resistance.
- See the pesticide label for more information on resistance management. For more information on resistance management strategies or IPM options for a specific pest, contact your local OMAFRA specialist or IPM consultant.

1. Using Pesticides in Ontario

The information in this chapter is updated regularly. For up-to-date information, visit ontario.ca/usingpesticides. Some of the information in this generic chapter may not apply to all crops.

Read the label before use.

Product labels may change.

Review the Grower Pesticide Safety Course Manual.
www.opep.ca/index.cfm/learning-resources/e-manuals/

Keep detailed spray records.

Federal Registration of Pesticides

Before a pesticide can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act) and be classified under the provincial *Pesticides Act*. The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticides for use in Canada following an evaluation of scientific data to ensure that the product has value. It also ensures that any human health and environmental risks associated with its proposed uses are acceptable.

The PMRA re-evaluates registered pesticides to determine whether today's health and environmental protection standards are still met when the pesticide is used according to the label. Outcomes of a re-evaluation can be:

- no change to the registration
- amendments to the label (e.g., changes to personal protective equipment requirements, restricted entry intervals, buffer zones)
- modifications to existing Maximum Residue Limits (MRLs)
- elimination or phasing-out of certain uses or formulations
- discontinuation of the registration

The pesticide label is a legal document. Follow all label directions. Labels for all registered pesticides are under "Search Pesticide Labels" on the PMRA website at www.healthcanada.gc.ca/pmra. Ensure you have the most current label and are aware of any re-evaluation decisions.

Regulation of Pesticides in Ontario

The Ministry of the Environment and Climate Change (MOECC) is responsible for regulating the sale, use, transportation, storage and disposal of pesticides in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09. All pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at ontario.ca/e-laws or by calling ServiceOntario at 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

Before a federally registered pesticide can be sold or used in Ontario, it must be classified under the provincial *Pesticides Act*. The Ontario pesticide classification system consists of 12 classes. Ontario's Pesticides Advisory Committee (OPAC) is responsible for assessing new pesticide products and recommending to the MOECC the classification of these products. Pesticide products are classified on the basis of their toxicity, environmental and health hazard, persistence of the active ingredient or its metabolites, concentration, usage, federal class designation (e.g., domestic, commercial, restricted) and registration status. The provincial classification system provides the basis for regulating the distribution, availability and use of pesticide products in Ontario. Once approved by the MOECC, classified products are posted on the MOECC website at ontario.ca/pesticides.

Certification and Licensing

Certified Farmers and Their Assistants

Growers must be certified through the Grower Pesticide Safety Course in order to buy and use Class 2 and 3 pesticides on their farms. They do not require this certification to buy and use Class 4, 5, 6 or 7 pesticides, however, a grower needs to provide his/her Farm Business Registration Number or a signed "Farmer Self Declaration to Enable Purchase of a Class 4 Pesticide" form to the vendor when buying Class 4 pesticides. For information about certification for growers and training for assistants to growers, visit the Ontario Pesticide Education Program website at www.opep.ca or call 1-800-652-8573.

Class 12 Requirements for Growers

Starting on July 1, 2015, new requirements will be phased in for growers who plan to purchase or plant neonicotinoid-treated corn (silage or grain) or soybean seed in Ontario. For more information on the training and reporting requirements for growers, visit the MOECC website at ontario.ca/pesticides, then click on "Neonicotinoid regulations."

Commercial Applicators (Exterminators) and Their Assisting Technicians

For more information about exterminator licensing and technician training, visit:

- the Ontario Pesticide Training and Certification website at www.ontariopesticide.com or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide-technician or call 1-800-265-5656 or e-mail pic@hort-trades.com
- the Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Exception Uses Under the Cosmetic Pesticide Ban

Pesticides listed in this publication are meant for Exception Uses (e.g., agriculture) under the Cosmetic Pesticide Ban unless the active ingredient is listed under Class 11 pesticides in Ontario Regulation 63/09.

For information about requirements under the *Pesticides Act* and Regulation 63/09, for golf courses and other excepted uses for turfgrass, including mandatory golf course IPM accreditation, go to ontario.ca and search for:

- Pesticides and Golf Courses
- Specialty Turf and Specified Sports Fields

For more information about requirements in the *Pesticides Act* and Regulation 63/09 for the exception regarding the use of pesticides to maintain the health of trees, go to ontario.ca and search for:

- Tree Care Specialists

For more information about pesticide regulations, certification and licensing, see:

- Inside front cover of this publication
- Pest Management Regulatory Agency (PMRA) website: www.healthcanada.gc.ca/pmra
- PMRA Pest Management Information Service: 1-800-267-6315 or TTY 1-800-465-7735 (from within Canada) or 1-613-736-3799 (from outside Canada)
- Ontario Ministry of the Environment and Climate Change (MOECC) website: ontario.ca/pesticides
- Regional MOECC Pesticides Specialist (See Appendix H. *Ontario Ministry of the Environment and Climate Change Regional Contact Information*, on page 131.)
- Ministry of Agriculture, Food and Rural Affairs (OMAFRA) website: ontario.ca/omafra
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) website: www.opep.ca
- Ontario Pesticide Training & Certification website: www.ontariopesticide.com
- Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide-technician
- IPM Council of Canada website: www.ontarioipm.com or www.ipmcouncilcanada.org
- Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Pesticide Application Information

When you decide to use a pesticide, choose the most appropriate formulation and application method for your situation. Use only properly calibrated sprayer equipment. Choose less toxic and less volatile alternatives when possible. Take all possible precautions to prevent the exposure of people and non-target organisms to the pesticide. Read the most current pesticide label thoroughly before application. The label provides important information, such as:

- directions for use (e.g., rates of application, crops/sites it can be used on, target pests, crop rotation restrictions, total number of applications, droplet size/nozzle type, application equipment, timing, appropriate weather conditions)
- required personal protective equipment (PPE)
- hazard symbols and warnings
- restricted entry intervals
- pre-harvest intervals
- buffer zones
- precautionary statements
- steps to be taken in case of an accident
- disposal

For more information on hazards, consult the Material Safety Data Sheet (MSDS) or contact the manufacturer.

For more information on pesticide application, see:

- Sprayers 101 at www.sprayers101.com
- OMAFRA Factsheet *Pesticide Drift from Ground Applications*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos at www.opep.ca/index.cfm/learning-resources/videos/
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- OMAFRA Factsheet *Pesticide Contamination of Farm Water Supplies — Recommendations on Avoidance, Clean-up and Responsibilities*

Restricted Entry Intervals

Restricted Entry Interval (REI) is the period of time after a pesticide has been applied that agricultural workers or anyone else must not do hand labour tasks in treated areas. The REI allows the pesticide residues and vapours to dissipate to safe levels for work to be done.

An REI can range from 1 hr to several days. A pesticide label may state different REIs that are specific to a crop and post-application task (e.g., scouting, harvesting). If the REI is not stated on a label for agricultural crops, use a 12-hr REI. For golf courses and residential turf applications, the spray solution must be dry before entry can occur.

Hand labour tasks involve substantial worker contact with treated surfaces such as plants, plant parts or soil. Examples of these activities include planting, harvesting, pruning, detasseling, thinning, weeding, scouting, topping, sucker removal, mowing, roguing and packing produce into containers in the field or greenhouse. You can only do these tasks after the REI has passed. Hand labour generally does not include operating, moving or repairing irrigation or water equipment, except for hand-set irrigation.

A Certified Farmer or Licensed Commercial Applicator (i.e., a holder of the appropriate Exterminator License, such as an Agriculture Exterminator Licence or a Greenhouse/Interior Plant Exterminator Licence) may need to re-enter a treated area to do short-term tasks before the end of the REI. In these cases, the Certified Farmer or Licensed Commercial Applicator may re-enter 4 hr after the application wearing a NIOSH-approved respirator and any other protective clothing (PC) and the personal protective equipment stated on the label for mixing and loading. This Certified Farmer or Licensed Commercial Applicator (exterminator) must not be in the treated area during the REI for more than a total of 1 hr in any 24-hr period.

See Figure 1–1 for an example of a 24-hr REI on a pesticide label.

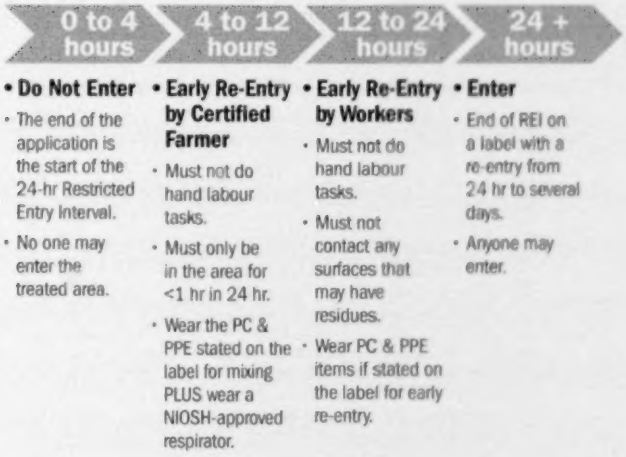
0 to 4 hours
4 to 12 hours
12 to 24 hours
24 + hours
• Do Not Enter
• The end of the application is the start of the 24-hr Restricted Entry Interval.
• No one may enter the treated area.
• Early Re-Entry by Certified Farmer
• Must not do hand labour tasks.
• Must only be in the area for <1 hr in 24 hr.
• Wear the PC & PPE stated on the label for mixing PLUS wear a NIOSH-approved respirator.
• Early Re-Entry by Workers
• Must not do hand labour tasks.
• Must not contact any surfaces that may have residues.
• Wear PC & PPE items if stated on the label for early re-entry.
• Enter
• End of REI on a label with a re-entry from 24 hr to several days.
• Anyone may enter.

Figure 1–1. Example of a 24-hr REI on a pesticide label.

Certified Farmers and Licensed Commercial Applicators should plan pesticide applications around work tasks so that no one needs to re-enter treated areas before the restricted entry interval has passed.

Days to Harvest Intervals for Food Crops (Pre-harvest, Pre-grazing and Feeding Intervals)

These intervals state the minimum time that must pass between the last pesticide application and the harvesting of the crop or the grazing and cutting of the crop for livestock feed. If you harvest a crop before the pre-harvest interval (PHI) has passed, there may be pesticide residues in excess of the maximum residue limits (MRLs) set by PMRA.

"Up to the day of harvest" means the same as 0 days PHI; however, the REI may be more restrictive (e.g., a 12-hr restricted entry interval) and must be observed for harvesting that occurs on the day of pesticide application.

To avoid exceeding the maximum residue limits, always follow the directions on the label.

Buffer Zones

Buffer zones, or no-spray areas, are areas left untreated to protect an adjacent sensitive area, such as sensitive terrestrial and aquatic habitats. Generally, a buffer zone is the downwind distance separating the point of direct pesticide application from the nearest boundary of a sensitive habitat. For soil fumigation, a buffer zone is an area established around the perimeter of each application block.

Leave a suitable buffer zone between the treatment area and adjacent sensitive area. Buffer zones may vary depending on the method of application (e.g., aerial, field boom, air blast). Check the pesticide labels for buffer zone requirements.

Sensitive terrestrial habitats include hedgerows, grasslands, shelterbelts, windbreaks, forested areas and woodlots.

Sensitive freshwater habitats include lakes, rivers, streams, creeks, reservoirs, marshes, wetlands and ponds.

Health Canada's PMRA has an online spray drift calculator that allows applicators to modify the buffer zones specified on the product label based on weather conditions, the category of the spray equipment and the droplet size. For more information, see the Buffer Zone Calculator at www.hc-sc.gc.ca/cps-spc/pest/agri-commerce/drift-derive/calculator-calculatrice-eng.php.

Setback Distances for Water Bodies

It is an offence under the federal *Fisheries Act* to introduce into water any material that may be harmful to fish or fish habitat, and under the *Species at Risk Act*, to impact endangered or threatened fishes and fresh water mussels. To protect these waters, applicators must determine a suitable setback distance between the area to be protected and the area where pesticide treatments are planned (if the setback distance is not specified on the pesticide label). The protected area includes the water body as well as adjacent riparian (riverbank) areas that contribute to fish food and habitat.

Protect the Environment

Protect Water Sources

According to the British Crop Protection Council (BCPC), 40%–70% of surface water pesticide contamination comes from mixing and filling areas.

Where possible, load or mix pesticides on impermeable surfaces located safely away from watercourses or environmentally sensitive areas. Collect drainage and run-off and dispose of it safely (*Your Guide to Using Pesticides*, BCPC 2007).

Clean your spray equipment away from wells, ponds, streams and ditches. Apply the diluted rinse water (usually at a ratio of 10:1) to the treatment area (crop), but do not exceed the pesticide rate recommended on the label.

Do not make a direct connection between any water supply (e.g., public supply, wells, watercourse or pond) and a spray tank. Use an anti-backflow device or intermediate system to prevent back-siphoning that could contaminate the water supply.

Immediately contain and clean up any spills to prevent contamination to water sources.

Check the pesticide label for specific instructions on protection of water sources.

For more information on protecting water sources, see ontario.ca/crops:

- OMAFRA Factsheet *Pesticide Contamination of Farm Water Supplies — Recommendations on Avoidance, Cleanup and Responsibilities*
- OMAFRA Factsheet *Groundwater — An Important Rural Resource: Protecting the Quality of Groundwater Supplies*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13

Bee Poisoning

Honeybees, native bee species and other pollinating insects are important pollinators for many Ontario crops. Insecticides, some of which may negatively affect bees, require careful management to achieve both pollination and insect control. Growers and licensed commercial applicators can protect bees by following these suggestions:

- Time insecticide applications to minimize bee exposure (e.g., apply post bloom). Daytime treatments, when bees are foraging, are most hazardous. Insecticide applications in the evening are the safest, unless there is evidence of a strong temperature inversion or high humidity. Under normal circumstances, spraying after 8 p.m. allows the spray to dry before the bees are exposed to it the next day. Spraying during early morning is the next best time, when fewer bees are foraging, but pesticide residues may still be present. Spraying should be completed well before 7 a.m. While honeybees and most other pollinating insects do not usually forage at temperatures below 13°C, bumblebees do. If you plan to spray in the morning, contact beekeepers who have bees within 5 km of your crop and spray site. The beekeepers may then have the option of taking any possible protective action.
- Do not apply insecticides while fruit trees are in bloom. The *Bees Act* makes it an offence to do so in Ontario. Do not spray any flowering crop on which bees are foraging.
- To prevent drift toward nearby hives, do not apply insecticides on windy days or when there is evidence of a strong temperature inversion.
- Bees and other pollinators may be poisoned by visiting flowering weeds, trees and cover crops that have come into contact with an insecticide via spray drift or drift of insecticide-contaminated dust during planting. Avoid spray drift to flowering weeds that are adjacent to or within the target field. Where possible, mow down flowering cover crops or flowering weeds in and bordering target fields prior to spraying to help safeguard the bees. Control dandelions and other flowering weeds within fields before spraying or planting seeds treated with an insecticide. Take measures to reduce movement of dust from insecticide seed treatments to flowering trees, weeds and water sources that are in or adjacent to the target field. For more information on reducing dust movement, see PMRA's *Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices* at www.hc-sc.gc.ca/cps-spc/pubs/pest/_fact-fiche/pollinator-protection-pollinisateurs/treated_seed-semences_traitees-eng.php.

- Systemic insecticides may also pose a high risk to bees and other insect pollinators. Bees can be exposed to insecticide residues in or on flowers, leaves, pollen, nectar and/or surface water. Do not apply insecticide or allow it to drift onto blooming crops or off-site habitat if bees are foraging in or adjacent to the treatment area.
- Beekeepers should remove honeybee colonies as soon as pollination is complete in the crop and before any insecticides are applied post bloom. If the colonies cannot be removed in time, beekeepers can place burlap or cloth soaked in water at the entrance of the hive to disrupt the flight of the bees for up to 12 hr and provide more time for spray to dry. To help prevent overheating of the hive during this time, keep an opening of 2.5 cm on each side of the hive entrance so bees can still get out and ventilate the hive. Also, the water on the burlap or cloth will help cool the colony.
- If there is a risk of honeybee poisoning, try to choose an insecticide that is not highly toxic to bees. When there is a choice, choose a product formulation that is less hazardous to bees.
- Always read the most current label for guidance.
- Before applying a pesticide or planting with insecticide-treated seed, advise local beekeepers so they can move colonies out of the danger area, if this is an option.

Manage Drift

Pesticide drift is the aerial movement and unintentional deposit of pesticide outside the target area. Drift results in wasted product and may compromise crop protection and also may adversely affect nearby sensitive environmental areas, crops and wildlife. The following strategies can help reduce the risk of pesticide drift:

- Do not spray when wind speeds are high or gusty. These conditions increase the potential for spray and vapour drift. Check pesticide labels for allowable wind speeds for spraying. However, not all labels provide this specific information.
- Constantly monitor wind conditions during spraying using a good-quality wind meter. Record the wind speed and direction. As wind conditions change, you may need to make adjustments to further reduce the drift potential, such as increasing water volume, minimizing nozzle-to-target distance, changing nozzle technology, changing fields because of surrounding influences or stopping spraying until conditions improve.
- Do not spray during periods of dead calm. Periods of dead calm may occur in early morning or late evening, at which time the temperature is usually cooler and the relative humidity is typically higher, which can result in the spray droplets remaining aloft, like fog. When the wind picks up, these spray droplets can move away from the target area, possibly causing injury to adjacent non-target areas. Off-target drift in calm conditions can occur hours after the spray event was completed.

Temperature inversions create problems for spray applicators because pesticide spray can:

- stay concentrated for long periods over the target
- move with the cool air over considerable distances when the breeze picks up
- move down slopes and concentrate in low-lying regions
- drift unpredictably as the inversion dissipates during the morning

Field air temperatures are often very different from local or regional forecasts, so the most reliable method of detecting inversion conditions is to measure temperatures at, and several metres above, the ground. Spray applicators can recognize a temperature inversion when:

- there is a big difference between the daytime and nighttime temperatures
- early evening and nighttime wind speeds are considerably less than during the day
- sounds seem to carry farther
- odours seem more intense
- daytime cumulus clouds collapse toward evening
- overnight cloud cover is 25% or less
- mist, fog, dew or frost occur
- smoke or dust hangs in the air and/or moves laterally in a sheet

Temperature inversions start to form 3 hr prior to sunset, become stronger as the sun sets and continue until sunrise when the surface warms and air mixing begins. **If you suspect there's an inversion, don't spray. Often, warnings for the risk of inversions are stated right on the product label.**

- Use the sprayer output specified on the pesticide label.
- Use a nozzle that will produce the droplet size specified on the pesticide label or delivers droplets appropriate for the job. Nozzles that produce fine droplets are rarely, if ever, required.
- Where practical, use air induction nozzles, which significantly reduce drift compared to conventional nozzles.
- Check the height of the boom to the target or distance from airblast boom to the target. Minimize the distance as much as possible while still maintaining spray uniformity.
- Establish buffer zones for the protection of adjacent sensitive areas. Some pesticide labels will state buffer zone setbacks; follow these carefully.
- Use spray plume protection where practical or available (hoods, shrouds, screens or air curtains).
- Use drift-reducing adjuvants in the spray tank as directed on the label. Mechanical or hydraulic agitations have been shown to reduce the effectiveness of certain drift-reducing adjuvants. Be aware that certain combinations of anti-drift adjuvants and air-induction nozzles have been shown to increase the incidence of fine droplets that will drift.
- When possible, use non-volatile pesticide formulations or products.

For more information about spray drift, see:

- Sprayers 101: www.sprayers101.com
- OMAFRA website: ontario.ca/spraydrift
- OMAFRA Factsheet *Pesticide Drift from Ground Applications*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos *How to Manage Spray Drift* and *Spray Drift Reduction Through Air Induction*, available at www.opep.ca/index.cfm/learning-resources/videos/chapter-18-drift-of-pesticides/

Waste Management (container disposal)

Empty Pesticide Containers Up to 23 L

Never re-use empty containers.

The Ontario Empty Pesticide Container Recycling Program, an industry-led program, is available free of charge to growers and commercial applicators. Through this program, you can return triple-rinsed or pressure-rinsed plastic pesticide and fertilizer containers up to 23 L to container collection depots located throughout the province. Remove the cap and booklet from the pesticide container before recycling. To locate the closest container collection depot, visit www.cleanfarms.ca, call your local dealer or contact CleanFARMS at 416-622-4460 (toll-free at 1-877-622-4460) or info@cleanfarms.ca.

Empty Pesticide Containers Greater Than 23 L

Growers and commercial applicators should return pesticide containers that are greater than 23 L in size to the point of sale or to the manufacturer for disposal. Contact your local dealer for details on disposal of these containers, or contact CleanFARMS at 416-622-4460 (toll-free at 1-877-622-4460) or info@cleanfarms.ca.

Empty Seed and Pesticide Bags

Growers can return their empty seed and pesticide bags to select retail locations. Contact your local dealer for details on disposal of these empty seed and pesticide bags, or contact CleanFARMS at 416-622-4460 (toll-free at 1-877-622-4460) or info@cleanfarms.ca.

Surplus Spray Mix

The best approach is to plan the spray job accurately to avoid creating a surplus.

When this is unavoidable, dispose of excess spray mix by spraying it on other crops that require an application of this pesticide. Before spraying, check the label to make sure the pesticide is registered for use on that other crop.

If you cannot find another allowable crop to spray, then dilute the remaining spray mix by adding 10 parts of water for each 1 part of spray mix. The diluted solution can be safely applied to the original treated area as long as you do not exceed the pesticide rate recommended on the label. Be sure to check the label for any restrictions about crop rotation, days to harvest or disposal of surplus spray mix.

Never re-spray the treated field with undiluted spray mix. Spraying an area twice at the same pesticide rate will double the labeled pesticide rate. This may cause illegal pesticide residues in the harvested crop or harmful residues in the soil that can cause crop damage.

Surplus Pesticide Disposal

Be sure to safely dispose of pesticides that you do not need or cannot use. Options for proper disposal include:

- Contact the supplier. It is sometimes possible to return unused pesticide if it is still in its original, unopened container.
- Hire a waste hauler who is licensed under Part V of the *Environmental Protection Act* to carry hazardous wastes. Look in the Yellow Pages of your telephone directory under Liquid Waste Removal.
- CleanFARMS operates a free Obsolete Pesticide Collection Program throughout the province every three years. To locate the closest collection point and date, visit the CleanFARMS website (www.cleanfarms.ca), contact CleanFARMS at 416-622-4460 (toll free at 877-622-4460) or info@cleanfarms.ca or contact your local dealer for program details.
- Contact your municipality to see if any waste collection days are scheduled and verify whether quantities of agricultural pesticides will be accepted.

Storing Pesticides

Ontario's *Pesticides Act* and Regulation 63/09 provide details on storage requirements for pesticide storage facilities. As shown in Table 1–1, the storage requirements that must be followed are dependent on which classes of pesticides you store.

Table 1–1. Requirements for farm pesticide storage facilities

	Pesticide Classes		
Storage requirements	**Class 2**	**Class 3**	**Class 4, 5, 6 & 7**
No contact with food or drink	**YES**	**YES**	**YES**
Not an impairment to health and safety	**YES**	**YES**	**YES**
Clean and orderly	**YES**	**YES**	**YES**
Warning sign G posted*	**YES**	**YES**	**YES**
Emergency telephone numbers posted**	**YES**	**YES**	**YES**
Vented to outside	**YES**	**YES**	NO
Limited access (locked)	**YES**	**YES**	NO
No floor drain	**YES**	**YES**	NO
Respiratory protection and protective clothing kept readily available	**YES**	**YES**	NO
Area used primarily for pesticides	**YES**	NO	NO

Note: Sufficient precautions are needed in your storage area to prevent the pesticide from entering the natural environment. Ensure your floor drain does not enter the natural environment.

* See ontario.ca for requirements for warning sign G (Search for sample warning signs for pesticide use). These signs can be purchased from your pesticide dealer/vendor.

** Emergency contact numbers must include telephone numbers for the local fire department, hospital and poison control centre. The number for the MOECC Spills Action Centre (1-800-268-6060) should also be readily available.

For more information about storing pesticides, see:

- OMAFRA Factsheet *Farm Pesticide Storage Facility*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Grower Pesticide Safety Course Manual*, available at www.opep.ca. Select "Learning."

Pesticide Spills

If a pesticide spill causes, or is likely to cause, an adverse effect that is greater than that which would result from the proper use of the pesticide, you must notify the Ministry of the Environment and Climate Change Spills Action Centre at 1-800-268-6060 (24 hr a day, 7 days a week) and your municipality.

A spill is defined as a discharge of pollutant that is abnormal in quality or quantity, from or out of a structure, vehicle or other container into the environment. An incident such as an overturned pesticide sprayer that results in the loss of the spray solution to the environment is an example of a spill. A pesticide container that ruptures and leaks its contents is another example of a spill. The discharge or spraying of a pesticide in an unapproved area is also considered a spill.

Before you begin to clean up a spill of any nature, remember to protect yourself against pesticide exposure. Wear the proper protective clothing and personal protective equipment. If the spill occurs inside an enclosed area (e.g., a pesticide storage area or a vehicle during transport), ventilate the area first. Once you have protected yourself and removed other persons or animals from the spill site, take additional measures to stop the spill at the source and prevent it from spreading and/or contaminating watercourses. Specific precautions, emergency contact information and first aid procedures may be found on the label.

For minor spills, it may be possible to rectify the problem:

- **For a liquid spill** — Cover the spill with a thick layer of absorbent material such as kitty litter, vermiculite or dry soil. Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.
- **For a dust, granular or powder spill** — Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.

For major spills, it is essential to stop the spill from spreading.

The clean-up guidelines above may not be appropriate for all spill situations. Once you have contained the spill, follow directions from the manufacturer and regulatory authorities on cleaning the contaminated area.

Some of the information contained in this chapter is not authoritative. It is derived from the *Pesticides Act*, Ontario Regulation 63/09 and the federal *Pest Control Products Act, Fisheries Act* and *Species at Risk Act* and is for informational purposes only. Efforts have been made to make it as accurate as possible, but in the event of a conflict, inconsistency or error, the requirements set out in the referenced legislation take precedence. For specific legal details, please visit ontario.ca/laws (for Ontario legislation) and www.laws.justice.gc.ca (for federal legislation) and consult your lawyer if you have questions about your legal obligations.

For information on preventing spills, see:

- OMAFRA Factsheet *Ways to Avoid Pesticide Spills*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Grower Pesticide Safety Course Manual*, available at www.opep.ca. Select "Learning."

For pesticide poisonings and pesticide injuries, call:

Poison Information Centre: 1-800-268-9017

(TTY) 1-877-750-2233

For more information, see Emergency and First Aid Procedures for Pesticide Poisoning on inside back cover.

2. Pesticide Toxicity and Activity

LD_{50} is a measure of relative toxicity. It is the amount of product in milligrams used, per kilogram of body weight, that kills 50% of the test animals. This is commonly measured as the acute oral LD_{50}, which refers to the toxicity of the chemical when it is ingested through the mouth or nose. Dermal LD_{50} figures are also available. These refer to the toxicity of the chemical when it enters the body through the skin. The lower the LD_{50} figure, the more toxic the product is to humans.

The LD_{50} of various pesticides is listed in Table 2–1. *Insecticide and Miticide Toxicity* and Table 2–2. *Fungicide Toxicity*.

Note: Many pesticides with low acute toxicity cause long-term effects in laboratory animals. Users are therefore warned that even pesticides with high LD_{50} values could be detrimental to human health. Reduce exposure to all pesticides to a minimum by wearing protective clothing, including latex gloves, goggles and long-sleeved shirts. See Chapter 1 for more details.

Read every product label to ensure that the product is used properly and safely.

Pesticide Injury to Vegetable Crops

Although greenhouse pesticides have been selected and formulated to avoid plant injury, damage can still occur under some conditions. Consider these general rules before applying pesticides:

- No product is safe on all plants under all conditions, although wettable powders are generally less injurious than liquid formulations.
- Weather conditions at the time of application are important. Pesticides are more likely to harm plants when applied during bright, sunny weather than if applied during dull, overcast conditions.
- Well-watered, unstressed plants are less likely to be damaged by pesticides.
- Low-volume applications are generally less likely to cause plant injury than high-volume applications.
- Excessive spray pressure may damage leaf tissue.

Table 2–1. Insecticide and miticide toxicity

Common Name or Active Ingredient	Trade Name	Oral LD_{50} (mg product/ kg body weight)*
abamectin	Avid 1.9% EC	300
acequinocyl	Shuttle 5 SC	>5,000
acetamiprid	Tristar 70 WSP	1,064
Autographa californica Nucleopolyhedrovirus FV11	Loopex	not available
Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG	>5,000
Bacillus thuringiensis subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	>5,000
Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF DiPel WP	>5,050
	Foray 48BA	>5,000
Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	BioProtec 3P BioProtec CAF	not available
Bacillus thuringiensis subsp. *kurstaki* strain SA-12	Thuricide HPC	>7.2E + 10 CFU/kg
Beauveria bassiana strain ANT-03	Bio-Ceres G WB Bio-Ceres G WP	>5,000
Beauveria bassiana strain GHA	BotaniGard 22WP	>5,000
bifenazate	Floramite SC	>5,000
chlorantraniliprole	Coragen SC	>5,000
chlorfenapyr	Pylon	560–567
citric acid + lactic acid	Cyclone	Citric acid: >3,000 Lactic acid: >4,000
cyprodinil + fludioxonil	Palladium WG	>5,000
cyromazine	Citation 75 WP	>4,460
dichlorvos	DDVP 20% EC	56
etoxazole	TetraSan 5 WDG	4,500
fenbutatin oxide	Vendex 50W Vendex 50WP	>5,000
ferric phosphate	Sluggo	>5,000
flonicamid	Beleaf 50 SG	>2,000
fludioxonil + cyprodinil	Switch 62.5 WG	>5,000

* Figures obtained from Material Safety Data Sheets for each individual product.

Table 2–1. Insecticide and miticide toxicity

Common Name or Active Ingredient	Trade Name	Oral LD_{50} (mg product/ kg body weight)*
garlic	Influence LC Influence WP	>5,000
hydrogen peroxide	Storox	330
imidacloprid	Intercept 60 WP	1,858
lambda-cyhalothrin	Matador 120 EC	93
malathion	Fyfanon 50% EC	89
	Malathion 25 W	1,375
	Malathion 85 E Pro Malathion 50 EC	5,500
Metarhizium anisopliae strain F52	Met52 EC	not available
mineral oil	Purespray Green Spray Oil 13E	>5,000
naled	Dibrom	235
permethrin	Ambush 50 EC	2,280
	Bio-environmental Permethrin	not available
	Pounce 384 EC	1,030
potassium salts of fatty acids	Neudosan Commercial Opal Insecticidal Soap Opal2 Insecticidal Soap Safer's Insecticidal Soap	>5,000
potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	>5,000
pymetrozine	Endeavor 50 WG	>5,000
pyridaben	Dyno-Mite 75 WP	1,930
pyriproxyfen	Distance	>3,773
spinetoram	Delegate WG	>5,000
spinosad	Entrust 80 W Entrust SC Success	>5,000
spiromesifen	Forbid 240 SC	>2,000
spirotetramat	Kontos	>2,000
tebufenozide	Confirm 240 F	>5,000
thiamethoxam	Flagship WG	>5,000

* Figures obtained from Material Safety Data Sheets for each individual product.

Table 2–2. Fungicide toxicity

Common Name or Active Ingredient	Trade Name	Oral LD_{50} (mg product/ kg body weight)*
Bacillus amyloliquefaciens strain D747	Double Nickel 55 or Double Nickel LC	>5,000
Bacillus subtilis strain MBI 600	Serifel	>5,000
Bacillus subtilis strain QST 713	Cease Rhapsody ASO	>5,000
Bacillus subtilis var. *amyloliquefaciens* strain FZB24	Taegro2 WP Taegro WP	very low acute oral toxicity
bacteriophage of *Clavibacter michiganensis* subsp. *michiganensis*	AgriPhage-CMM	no toxicity reported
boscalid + pyraclostrobin	Pristine	>1,490
captan	Captan 50 WP Captan 80 WP Maestro 80 DF Supra Captan 80 DF	>5,000
copper hydroxide	Kocide 3000 DF	1,847
copper octanoate	Cueva Commercial	>2,000
copper oxychloride	Copper Spray Fungicide WP	1,600
cyazofamid	Torrent 400 SC	>5,000
cyprodinil + fludioxinil	Palladium WG	>5,000
fenhexamid	Decree 50 WDG	>2,000
ferbam	Ferbam 76 WDG	>5,000
Gliocladium catenulatum strain J1446	Prestop	>2,000
hydrogen peroxide	Storox	330
iprodione	Rovral 50 WP Rovrol WDG	>2,000
kasugamycin	Kasumin 2L	>5,000
mancozeb	Manzate 200 WP Manzate DF Manzate Pro-Stick	>5,000
mandipropamid	Revus	>5,000
metalaxyl-m	Ridomil Gold 480 EC Ridomil Gold 480 SL	1,172
mineral oil	Purespray Green Spray Oil 13E	>5,000
mono- and di-potassium salts of phosphorous acid	Confine Extra	>5,000
myclobutanil	Nova 40 W	3,129
oxathiapiprolin	Orondis	>5,000
penthiopyrad	Fontelis	>5,000
potassium bicarbonate	MilStop	2,700
propamocarb hydrochloride	Previcur N	2,000
pyrimethanil	Scala SC	>5,000
Reynoutria sachalinensis (extract)	Regalia Maxx	>5,000
Streptomyces griseoviridis strain K61	Mycostop WP	>5,000
Streptomyces lydicus strain WYEC 108	Actinovate SP	no toxicity reported
sulphur	Agrotek Vaporized Sulphur Bartlett Microscopic Wettable Sulphur Microscopic Sulphur WP	>5,000
	Kumulus DF	>2,200
	Microthiol Disperss	>2,000
tea tree oil	Timorex Gold	>2,000
Trichoderma harzianum Rifai strain KRL-AG2	RootShield Granules RootShield HC RootShield WP	Active ingredient is practically non-toxic, non-allergenic and non-pathogenic to mammals
Trichoderma harzianum Rifai strain T-22	Trianum G Trianum	>1.0 x 10^7 CFU/ animal

* Figures obtained from Material Safety Data Sheets for each individual product.

3. Biological Control Agents Used In Greenhouse Vegetable Crops

Greenhouse vegetable growers use biological control (biocontrol) agents as an integral part of their IPM programs for managing insect and mite pests. Table 3–1 lists commercially available biocontrol agents for major pest species in greenhouse vegetables.

Table 3–1. Biocontrol agents for major greenhouse pests

Use caution when using pesticides along with biocontrols because many pesticides are harmful to beneficial insects. Using even one application of harmful pesticide can prevent any further use of biocontrol agents for an extended period of time. Check the following websites for information on compatibility of pesticides with biocontrols: http://sideeffect.biobest.be/neveneffecten/3/ and www.koppert.mobi/en/side_effects/C/.

LEGEND: * = Parasitoids: These usually require only one host for completion of development, often killing it by living on or in its body.
** = Predators: These feed on their prey (pest) by catching them but otherwise live independently of them. They must consume more than one individual to reach maturity.
*** = Entomopathogen

Pests	Biocontrol Agent
Aphids: various species	*Aphelinus abdominalis* (parasitic wasp)*
Foxglove aphid (*Aulacorthum solani*)	*Aphidius colemani* (parasitic wasp)*
Green peach aphid (*Myzus persicae*)	*Aphidius ervi* (parasitic wasp)*
Melon aphid (*Aphis gossypii*)	*Aphidoletes aphidimyza* (predatory midge)**
Potato aphid (*Macrosiphum euphorbiae*)	*Beauveria bassiana* (fungus sold as BotaniGard, Bio-Ceres)***
	Chrysopa carnea (lacewing)**
	Hippodamia sp. (lady beetle)**
Caterpillars (loopers, European corn borers)	*Autographa californica* Nucleopolyhedrovirus (baculovirus sold as Loopex)***
	Bacillus thuringiensis subsp. *aizawai* (bacterium sold as XenTari)***
	Bacillus thuringiensis subsp. *kurstaki* (bacterium sold as DiPel, Foray, Bioprotec, Thuricide)***
	Trichogramma spp. (parasitic wasps)*
Fungus gnat (*Bradysia* and *Corynoptera* spp.)	*Atheta coriaria* (predatory beetle)**
	Bacillus thuringiensis subsp. *israelensis* (bacterium sold as VectoBac)***
	Dalotia coriaria (predatory beetle)**
	Gaeolaelaps gillespiei (predatory mite)**
	Steinernema sp. (nematode)**
	Stratiolaelaps scimitus (=*Hypoaspis miles*) (predatory mite)**
Leafminer (*Liriomyza* spp.)	*Dacnusa sibirica* (parasitic wasp)*
	Diglyphus isaea (parasitic wasp)*

Table 3–1. Biocontrol agents for major greenhouse pests

Use caution when using pesticides along with biocontrols because many pesticides are harmful to beneficial insects. Using even one application of harmful pesticide can prevent any further use of biocontrol agents for an extended period of time. Check the following websites for information on compatibility of pesticides with biocontrols: http://sideeffect.biobest.be/neveneffecten/3/ and www.koppert.mobi/en/side_effects/C/.

LEGEND: * = Parasitoids: These usually require only one host for completion of development, often killing it by living on or in its body.
** = Predators: These feed on their prey (pest) by catching them but otherwise live independently of them. They must consume more than one individual to reach maturity.
*** = Entomopathogen

Pests	Biocontrol Agent
Two-spotted spider mite (*Tetranychus urticae*)	*Amblyseius andersoni* (predatory mite)**
	Chrysopa carnea (lacewing)**
	Feltiella acarisuga (predatory midge)**
	Metarhizium anisopliae (fungus sold as Met52)***
	Neoseiulus (=*Amblyseius*) *californicus* (predatory mite)**
	Neoseiulus (=*Amblyseius*) *fallacis* (predatory mite)**
	Phytoseiulus persimilis (predatory mite)**
	Stethorus punctillum (predatory beetle)**
Whitefly (*Trialeurodes vaporariorum* or *Bemisia* spp.)	*Amblydromalus limonicus* (predatory mite)**
	Beauveria bassiana (fungus sold as BotaniGard, Bio-Ceres)***
	Chrysoperia carnea (lacewing)**
	Delphastus catalinae (predatory beetle)**
	Dicyphus hesperus (predatory bug)**
	Encarsia formosa (parasitic wasp)*
	Eretmocerus eremicus (parasitic wasp)*
	Eretmocerus mundus (parasitic wasp)*
	Metarhizium anisopliae (fungus sold as Met52)
Western flower thrips (*Frankliniella occidentalis*)	*Amblydromalus limonicus* (predatory mite)**
	Amblyseius swirskii (predatory mite)**
	Atheta coriaria (predatory beetle)
	Beauveria bassiana (fungus sold as BotaniGard, Bio-Ceres)
	Chrysoperia carnea (lacewing)**
	Dalotia coriaria (predatory beetle)**
	Metarhizium anisopliae (fungus sold as Met52)***
	Neoseiulus (=*Amblyseius*) *cucumeris* (predatory mite)**
	Orius spp. (predatory bug)**
	Steinernema feltiae (nematode)**
	Stratiolaelaps scimitus (= *Hypoaspis miles*) or *Gaeolaelaps gillespiei* (=*Hypoaspis aculeifer*) (predatory mite)**

4. Tomatoes

Products registered for greenhouse tomato insect and mite pests are listed in Table 4–1.
Products registered for greenhouse tomato diseases are listed in Table 4–2.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m^2). Thoroughly ventilate premises before re-entering on the day following treatment. **REI: 24 hr**
	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paintbrush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	16 g/60 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not apply more than once per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
9B	pymetrozine	Endeavor 50 WG	100–200 g in a minimum of 1,000 L water/ha	3	**Green peach aphid (*Myzus persicae*), melon aphid (*Aphis gossypii*).** Do not apply more than 200 g in 1,000 L water per application. Do not exceed 2 applications per crop cycle or 3 applications/yr in greenhouses with multiple crop cycles. Apply as a foliar spray. Do not re-apply for at least 7 days. On hard-to-wet plants add a non-ionic or organosilicone-based surfactant to improve coverage. **REI: 12 hr**
23	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate per single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L/ha (42 mL concentration) to 1,000 L/ha (30 mL concentration). Use the higher concentration for higher pest infestation levels. Interval between applications is at least 7–14 days. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
NC	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB	2–4 g/L water	0	Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L of spray volume will typically be required for 1 ha. This product is most effective when used early, before high insect populations develop. Re-apply as necessary within a 7-day interval. In case of pest outbreak, the product can be used every 3–5 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Do not re-enter treated areas until the spray has dried.**
		Bio-Ceres G WP			
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0 hr**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	Deters feeding. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
BANANA MOTH (*Opogona sacchari*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.8 kg/1,000 L water	0	Foliar application. Make application just prior to egg hatch. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stems is necessary (minimum of 300 L water/ha). Re-apply at 7-day intervals, as required by monitoring. **REI: NS**
		Bioprotec CAF *	1.6 L/1,000 L water		

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Table 4–1. Products registered for greenhouse tomato insect and mite pests

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BEET ARMYWORM (*Spodoptera exigu*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
CORN EARWORM (Tomato fruitworm) (*Helicoverpa (=Heliothis) zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
DUPONCHELIA FOVEALIS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	625 g/1,000 L water	0	Make applications when egg hatch is essentially complete, when larvae are small, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. Apply every 7 days as required by monitoring. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.8 kg/1,000 L water	0	Foliar and drench application. Make application when egg hatch is essentially complete, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well, and into the top layer of the soil around the base of the plant. Thorough coverage of foliage and stems is necessary. Re-apply at 7-day intervals, as required by monitoring. **REI: NS**
		Bioprotec CAF *	1.6 L/1,000 L water		
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**
EUROPEAN CORN BORER (*Ostrinia nubilalis*)					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	30 g/1,000 L water	2	Maximum application volume that can be used is 2,000 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		

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FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L water **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
LEAFMINERS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paintbrush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	1	***Liriomyza* spp.** Application should be made, preferably in 2,000–4,000 L water/ha. Do not apply more than 1,200 mL or less than 600 mL product/ha per application. Use in sufficient water to obtain uniform coverage. Apply no more than 3,600 mL product/ha per crop cycle. Do not apply through any type of irrigation system. **REI: Do not re-enter treated areas until residues have dried.**
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Tomato leafminer (*Tuta absoluta*).** Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
	Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	500–1,000 g/ 1,000 L water	0	**Lepidopteran leafminers.** Apply at egg hatch. Thorough coverage of foliage and stems is necessary. Apply every 7–10 days as required by monitoring. **REI: NS**
18	tebufenozide	Confirm 240F	0.6 L/ha	2	**Lepidopteran leafminers.** For suppression. Foliar application only. Use a high-volume sprayer. Apply at first egg hatch. Make a maximum of 4 applications per crop cycle, if monitoring indicates it is required. Applications should be made a minimum of 10 days apart. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. Do not use tebufenozide-treated tomatoes for processing. **REI: 12 hr**
28	chlorantraniliprole	Coragen	200 mL/1,000 L water	1	**Lepidopteran leafminers.** Apply at egg hatch. Re-apply if monitoring indicates it is necessary. Thorough coverage is important to obtain optimum control. Do not make more than 3 applications per crop cycle. Do not apply more than once every 7 days. Do not exceed a total of 750 mL product/ha per crop cycle. Apply in a maximum finished spray volume of 1,250 L/ha. **REI: 12 hr**

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LEAFROLLERS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paintbrush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
LOOPERS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 1,000 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	240 mL/1,000 L water		
		Success	120 mL/1,000 L water		
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray is dried.**
	Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	75–150 g/250 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use the higher rate range. Repeat applications at an interval to maintain control, usually 3–14 days. Maximum of 4 applications per season. **REI: NS**
		DiPel WP	150–300 g/ 250 L water/4,000 m^2	NS	**Cabbage looper (*Trichoplusia ni*)** Apply to upper and lower portions of the leaves to run-off. Repeat applications will be necessary if a new hatch occurs. **REI: NS**
		Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m^2)	NS	**Cabbage looper (*Trichoplusia ni*)** Apply using a high-volume spray. Apply at 10-day interval when loopers first appear. In general, larvae should be treated when they are newly hatched. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.92 kg/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
		Bioprotec CAF *	1.8 L/1,000 L water		
	Bacillus thuringiensis subsp. *kurstaki* strain SA-12	Thuricide HPC	5 L/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply at first sign of infestation when larvae are small and repeat at 7–10-day intervals when needed to maintain control. **REI: NS**

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
13	chlorfenapyr	Pylon	30 mL/100 L water	0	**Alfalfa looper (*Autographa californica*), Cabbage looper (*Trichoplusia ni*)** For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
18	tebufenozide	Confirm 240F	0.6 L (144 g a.i.)/ha	2	**Cabbage looper (*Trichoplusia ni*)** Foliar application only. Make a maximum of 4 applications per crop cycle. Applications should be made a minimum of 10 days apart. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. Do not use tebufenozide-treated tomatoes for processing. **REI: 12 hr**
28	chlorantraniliprole	Coragen	125 mL/1,000 L water	1	**Cabbage looper (*Trichoplusia ni*)** Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Repeat applications if monitoring indicates it is necessary. Do not make more than 3 applications per crop cycle. Do not apply more than once every 7 days. Do not exceed a total of 750 mL product/ha per crop cycle. The maximum finished spray volume is 1,400 L/ha. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex	50–200 mL/400 L water	0	Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days if monitoring indicates that it is necessary. **REI: Do not allow worker entry into treated areas until mists have settled.**
MEALYBUGS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
1B	naled	Dibrom	9.6 mL/100 m^3	2	**Two-spotted spider mite (*Tetranychus urticae*)** Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Application should be made preferably in 2,000–4,000 L water/ha. Do not apply more than 1,200 mL or less than 600 mL product/ha per application. Use in sufficient water to obtain uniform coverage. Apply no more than 3,600 mL product/ha per crop cycle. Do not apply through any type of irrigation system. **REI: Do not re-enter treated areas until the spray has dried.**
10B	etoxazole	TetraSan 5 WDG	226.8–453.6 g (4–8 packets)/ 378.5 L water	1	**Two-spotted and carmine spider mite (*Tetranychus urticae*)** Apply sufficient spray volume to ensure thorough coverage, to a maximum of 1,870 L/ha. Kills mite eggs and nymphs, but not adult mites. Apply at first sign of infestation and before large numbers of adult mites are present. Two applications may be made only if each application falls below a rate of 95 g a.i./ha. Make a second application if necessary, but no sooner than 21 days after the first application. Do not apply more than 2 times per crop cycle or within a 6-month period. This product is transovarial, therefore treated adult female mites will produce significantly fewer viable eggs. Use higher rates for moderate-to-heavy infestations, especially in dense plant canopies. **REI: 12 hr**
12B	fenbutatin oxide	Vendex 50W Vendex 50WP	50 g/100 L water	5	**Two-spotted spider mite (*Tetranychus urticae*)** Begin applications when mites appear and repeat as necessary to maintain control. Thorough coverage of all foliage, especially the under surface of leaves, is essential. The addition of a suitable spreader-sticker will usually result in superior mite control. Not highly injurious to beneficial mites and is non-toxic to honeybees. Do not spray when the temperature in the greenhouse is over 32°C. **REI: 12 hr; 48 hr for high foliar-contact activities**
13	chlorfenapyr	Pylon	20–30 mL/100 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage. Thorough coverage is essential for effective control. Actual spray volume will vary depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Allow a minimum of 21 days between applications. Do not apply more than a maximum of 2 applications per crop (0.69 kg a.i./ha). **REI: 12 hr**

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MITES (cont'd)					
21A	pyridaben	Dyno-Mite WP SanMite WP	284 g/1,000 L water/ha	2	**Two-spotted spider mite (*Tetranychus urticae*)** Maximum number of applications per crop cycle is 2. Apply at intervals of at least 28 days. Do not apply this product through any type of irrigation system. Do not apply as a fog. Do not use pyridaben-treated tomatoes for processing. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Two-spotted spider mite (*Tetranychus urticae*)** Under high pest population pressure, re-apply in 10–14 days as required by monitoring. Do not apply more than 2 applications per crop cycle. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
NC	*Metarhizium anisopliae* strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	For suppression. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial * Opal Insecticidal Soap	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Apply once weekly for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**
UN	bifenazate	Floramite SC	125 mL (30 g a.i.)/ 400 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Maximum number of sprays per crop cycle is 2. Make only 1 application of this product before rotating to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. **REI: 12 hr**

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PSYLLIDS					
6	abamectin	Avid 1.9% EC	30 mL/100 L water	1	**Tomato psyllid (*Bactericerca cockerelli*)** Application should be made preferably in 2,000–4,000 L water/ha. Do not apply more than 1,200 mL or less than 600 mL product/ha per application. Use in sufficient water to obtain uniform coverage. Apply no more than 3,600 mL product/ha per crop cycle. Do not apply through any type of irrigation system. **REI: Do not re-enter treated areas until the spray has dried.**
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**
SLUGS & SNAILS					
NC	ferric phosphate	Sluggo *	1.2–5 g/m^2	NS	**(*Deroceras* spp., *Arion* spp., *Helix* spp.)** Re-apply as the bait is consumed or at least once every 2 weeks if slugs and snails continue to be a problem. **REI: NS**
THRIPS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	30 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Maximum application volume that can be used is 2,000 L/ha. Apply when western flower thrips first appears. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
THRIPS (cont'd)					
NC	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB Bio-Ceres G WP	2–4 g/L water	0	Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L of spray volume will typically be required for 1 ha. This product is most effective when used early, before high insect populations develop. Re-apply as necessary within a 7-day interval. In case of pest outbreak, the product can be used every 3–5 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Do not re-enter treated areas until the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water **Drench:** 108 mL/10 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Do not re-enter treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	For suppression. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
TOBACCO BUDWORM (*Heliothis virescens*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.46–0.92 kg/1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
		Bioprotec CAF *	0.9–1.8/1,000 L water		
	Bacillus thuringiensis subsp. *kurstaki* strain SA-12	Thuricide HPC	2.5–5 L/1,000 L water	0	Apply at first sign of infestation when larvae are small and repeat at 7–10-day intervals when needed to maintain control. **REI: NS**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and other beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m^2). Thoroughly ventilate premises before re-entering on the day following treatment. **REI: 24 hr**
	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
3A	permethrin	Ambush 50 EC	20 mL/100 L water	1	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Apply to cover all foliage thoroughly. Repeat application as necessary to maintain control. **REI: NS**
		Bio-environmental permethrin	185 mL/1 L water	1	Spray for thorough coverage of upper and lower leaf surfaces or treated area. Apply when insects or damage first appears and then as necessary. Do not use when air temperature is less than 12°C or greater than 30°C. **REI: NS**
		Pounce 384 EC	260 mL/1,000 L water	1	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Apply to thoroughly cover all foliage. Repeat as necessary. **REI: Re-entry into treated areas is permissible as soon as the spray deposit has dried.**
4A	acetamiprid	Tristar 70 WSP	15 packs/2 ha (1 pack/1,333 m^2)	1	Do not make more than 2 applications/yr. Apply through drip irrigation to the growing media. Alternate applications with an insecticide with a different mode of action. Repeat if necessary at a 21-day treatment interval. **REI: 12 hr**
	imidacloprid	Intercept 60 WP	16 g/60 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not apply more than once per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
7C	pyriproxyfen	Distance	45 mL/100 L water	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. If necessary, make a second application from 14–28 days after the first application. Use longer interval when plants are not growing rapidly. Apply a maximum of 2 applications per cropping cycle. If the cropping cycle is less than 6 months, do not apply more than 2 applications/6 months. **REI: 12 hr**

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Table 4–1. Products registered for greenhouse tomato insect and mite pests

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Under high pest population pressure, re-apply in 10–14 days as required by monitoring. Do not apply more than 2 applications per crop cycle. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate/single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L/ha (42-mL concentration) to 1,000 L/ha (30 mL concentration). Use the higher concentration for higher pest infestation levels. Interval between applications is at least 7–14 days. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**
29 (formerly 9C)	flonicamid	Beleaf 50 SG	0.2 g/L water	0	Foliar application. Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Allow a minimum of 7 days between applications. Do not apply more than 2 applications per crop cycle. Apply sufficient volume to ensure good coverage. The spray volume can vary from 500–1,000 L/ha, depending on the size of the plants. The maximum volume should be used when plant foliage is dense. **REI: 12 hr**

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WHITEFLIES (cont'd)					
NC	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB Bio-Ceres G WP	2–4 g/L water	0	Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L of spray volume will typically be required for 1 ha. This product is most effective when used early, before high insect populations develop. Re-apply as necessary within a 7-day interval. In case of pest outbreak, the product can be used every 3–5 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Do not re-enter treated areas until the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	Deters feeding. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial * Opal Insecticidal Soap	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal2 Insecticidal Soap	1 part concentrate: 100 parts water	0	Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. **REI: NS**

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Table 4–2. Products registered for greenhouse tomato diseases

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BACTERIAL CANKER (BACTERIAL STEM CANKER) (*Clavibacter michiganensis* subsp. *michiganensis*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not make more than 3 applications per season. A minimum interval of 7 days between applications is required. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M1	copper hydroxide	Kocide 3000 DF *	1.86 kg (558 g a.i.)/ha	1	For suppression. Apply to propagation house tomatoes every 5 days to a maximum of 5 applications over a 4-week period. Apply to production house tomatoes every 7–10 days. **REI: 24 hr**
	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
	copper oxychloride	Copper Spray Fungicide WP *	3 kg/1,000 L water/ha	2	Apply early in the growing season and repeat at 7–10-day intervals. Do not apply more than 10 applications/yr. **REI: 24 hr**
NC	bacteriophage of *Clavibacter michiganensis* subsp. *michiganensis*	Agriphage — CMM	**Seedling treatment:** 12 mL/100 m^2 **Production treatment:** 40 mL/100 m^2	0	For suppression. Begin applications to seedlings (at the 4-leaf stage), immediately after planting or grafting. Apply treatments in 3–4-day intervals. Apply prior to or at the early onset of disease development, or when conditions are conducive to heavy disease pressure, and continue throughout the growing season. Thorough coverage and wetting of all foliage is essential for effective disease control. **REI: NS**
	citric and lactic acid	Cyclone	2.4% dilution in water solution	NS	For suppression. Apply prior to, or at the early stages of disease development. Apply as foliar spray until runoff. Interval of application is 5–10 days. Can leave white hydrosoluble residues on treated crop. Use of surfactant Liberate and LI700 can help achieve better coverage of leaves and better efficacy. **REI: Do not enter treated area until spray is dried.**
BACTERIAL SPECK (BACTERIAL BLIGHT) (*Pseudomonas syringae* pv. *tomato*)					
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat as necessary on a 7–10-day interval. **REI: NS**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
P5	*Reynoutria sachalinensis* extract	Regalia Maxx *	0.125%–0.25% v/v (1.25–2.5 mL/L) water	0	For suppression. Begin applications at the first sign of disease or when conditions become conducive for disease development. Repeat as necessary on a 7–10-day interval. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L/ha. **REI: Do not enter treated area until spray is dried.**

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BACTERIAL SPOT (BACTERIAL BLIGHT, BACTERIAL LEAF SPOT) (*Xanthomonas campestris* pv. *vesicatoria*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not make more than 3 applications per season. A minimum interval of 7 days between applications is required. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
EARLY BLIGHT (*Alternaria solani*)					
7	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	For suppression. Begin applications prior to disease development. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	0.5–2 kg/ha	0	Apply from flowering to fruiting. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not enter treated area until spray is dried.**
		Double Nickel LC	2.5–10 L/ha		
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
M3	mancozeb	Manzate 200 WP	2.25 kg/ha	7	Apply every 7–12 days to keep new growth covered. **REI: NS**
		Manzate DF	2.4 kg/ha		Apply every 7–12 days to keep new growth covered. **REI: 24 hr**
		Manzate Pro-Stick			

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GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*)					
2	iprodione	Rovral WP	100 g/100 L water	2	Spray to run-off ensuring good coverage of the plants, particularly stem nodes, immediately following any pruning. Begin application at the first sign of disease. **REI: 12 hr**
		Rovral WDG			
7	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	Begin applications prior to disease development. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
9	pyrimethanil	Scala SC	2 L/ha (800 g a.i./ha)	1	Apply at first sign of disease. Use a minimum spray volume of 250–600 L/ha. Do not apply more than 2 applications per growing season. Do not apply more than 1 application before alternating with a fungicide with a different mode of action. Ventilate for at least 2 hr after application. Proper ventilation after spraying is essential to avoid brown or necrotic spots that can be caused by the vapour activity of Scala SC. **REI: 24 hr**
17	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.75 kg a.i./ha)	1	Begin application when conditions favour disease development. Do not make more than 3 applications per crop cycle. Fenhexamid-treated greenhouse tomatoes cannot be used for processing. **REI: 4 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	**Foliar:** 1.25–3.6 kg/ha **Low disease pressure:** 0.9–1 kg/ha	0	For suppression. Apply from flowering to fruit maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not enter treated area until spray is dried.**
		Double Nickel LC	**Foliar:** 6.25–18 L/ha **Low disease pressure:** 4.5–5 L/ha		
	Bacillus subtilis strain QST 713	Cease	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat as necessary on a 7–10-day interval. **REI: NS**
		Rhapsody ASO			
46	tea tree oil	Timorex Gold *	1.5–2 L/ 400–1,200 L water/ha	2	Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventative treatments, apply at 7–14-day intervals, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.6 kg in a minimum of 250 L water/ha	0	One application will provide control for a period of 10–14 days, depending on disease pressure. Do not apply using any type of foggers or misters. Do not apply more than once per crop cycle. Do not use on plants that will be transplanted. **REI: Do not enter treated area until spray is dried.**

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*) (cont'd)					
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ha in a minimum of 200–3,000 L water	1	First application should be made when disease first appears; a second application should be made 7–10 days later. Do not make more than 2 applications per crop cycle. Test product on a small portion of the crop to ensure that a phytotoxic response will not occur. **REI: 24 hr**
M3	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	1	Apply at weekly intervals. **REI: NS**
NC	*Gliocladium catenulatum* strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate to high disease pressure. **REI: 4 hr**
	hydrogen peroxide	StorOx *	Dilute 100 mL in 10 L water Apply 300–950 L of diluted product/ha	0	For suppression. Spray when disease first appears or when conditions are favourable for disease development. Good coverage and wetting of the foliage is required. Under severe disease conditions, reduce spray intervals and use stronger dilution rates. **REI: Do not enter treated area until spray is dried.**
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield HC *	3.75–7.5 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet, but avoid run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**
P5	*Reynoutria sachalinensis* extract	Regalia Maxx *	0.25% v/v (2.5 mL/L)	0	For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat as necessary on a 7–10-day interval. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L/ha. **REI: Do not enter treated area until spray is dried.**

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LATE BLIGHT (PHYTOPHTHORA FOLIAR BLIGHT)					
33	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha in a minimum of 100 L water	1	***Phytophthora* spp., *Phytophthora infestans*** For suppression. Use a maximum of 5 foliar and/or chemigation applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
40	mandipropamid	Revus	400–600 mL/ha (100–500 g a.i./ha)	1	***Phytophthora infestans*** Water volume guidelines: small crop (0.6 m), use 285 L/ha; medium crop (1.2 m), use 627 L/ha; large crop (2.7 m), use 1,200–1,400 L/ha. Applications should begin prior to disease development. Do not make more than 4 applications per season. Apply to transplants only after they have been planted in the field. **REI: 12 hr**
44	*Bacillus subtilis* var. *amyloliquefaciens* strain FZB24	Taegro 2 WP Taegro WP	364 g/935.4 L water/ha	0	***Phytophthora infestans*** For suppression. Apply after emergence as a foliar spray. Continue applications at 7-day intervals when conditions are conducive to disease development. **REI: 0**
46	tea tree oil	Timorex Gold *	2–12 L/ 400–1,200 L water/ha	2	***Phytophthora infestans*** For suppression. Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, apply at 7–14-day intervals, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	***Phytophthora infestans*** Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
M3	mancozeb	Manzate 200 WP	2.25 kg/ha	7	Apply every 7–12 days to keep new growth covered. **REI: NS**
		Manzate DF Manzate Pro-Stick	2.4 kg/ha	7	Apply every 7–12 days to keep new growth covered. **REI: 24 hr**
NC	garlic powder	Influence WP	6.9 kg/1,000 L water/ha	0	***Phytophthora infestans*** May inhibit symptoms when used in conjunction with integrated pest management strategies. Apply preventively at first signs of disease. May be applied to crop foliage or to the substrate surface, depending on the targeted disease. Repeat applications at 7–14-day intervals. **REI: Do not enter treated area until spray is dried.**
U15	oxathiapiprolin	Orondis	0.175–0.35 L/ha	0	***Phytophthora infestans*, *Phytophthora capsici*** Foliar application only. Begin applications prior to disease development and continue on a 5–14-day interval. Use the higher end of the rate range and shorter interval when disease pressure is high. Do not make more than 4 applications/yr. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW					
3	myclobutanil	Nova WSP	340 g/1,000 L water/ha	3	Use a maximum of 1 application per crop cycle. Apply as soon as possible after initial infection. **REI: 12 hr**
46	tea tree oil	Timorex Gold *	2–12 L/ 400–1,200 L water/ha	2	***Leveillula taurica, Oidium lycopersici, O. neolycopersici*** Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, apply at 7–14-day intervals, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.6 kg in a minimum of 250 L water/ha	0	***Erysiphe polygoni, Leveillula taurica, Oidium lycopersici*** For suppression. Do not apply using any type of foggers or misters. Do not apply more than once per crop cycle. Do not use on plants that will be transplanted. **REI: Do not enter treated area until spray is dried.**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 200–3,000 L water/ha	1	***Oidium lycopersici, O. neolycopersici*** First application should be made when disease first appears; a second application should be made 7–10 days later. A third application can be made at a 7–10-day interval if conditions remain favourable for disease development. The shorter interval should be used when disease pressure is expected to be high. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. Do not make more than 3 applications per crop cycle. **REI: 24 hr**
M2	sulphur	Agrotek Vaporized Sulphur	0.4–3.2 g/1,000 m^2	NS	***Oidium lycopersici*** Use 1 vaporizer/1,000 m^2. Start using before plants show signs of infection. Use for 1–8 hr per night, 2–7 days/week. Do not apply if temperature is above 24°C and high humidity prevails. Certain species of beneficial insects are sensitive to sulphur. **REI: 2 hr**
		Bartlett Microscopic Wettable Sulphur *	750 g/1,000 L water/ha	1	Maximum of 10 applications per crop cycle. Apply weekly from onset of first symptoms and during conditions favouring disease. Two applications may be sufficient to control each incidence of disease. May cause slight foliar phytotoxicity. **REI: 24 hr**

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
NC	garlic powder	Influence LC	1.8% with high volume sprayer	0	***Oidium neolycopersici*** For suppression. Apply preventively or at first signs of disease. Repeat applications at 7–10-day intervals. Ensure thorough coverage of foliage. Do not exceed 18 L/ha. Do not use with ultra-low-volume sprayers. **REI: Do not enter treated area until spray is dried.**
		Influence WP	6.9 kg/1,000 L water/ha	0	***Oidium neolycopersici*** For suppression. Apply preventively at first signs of disease. May be applied to crop foliage or to the substrate surface, depending on the targeted disease. Repeat applications at 7–14-day intervals. **REI: Do not enter treated area until spray is dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	***Leveillula taurica*** For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium bicarbonate	MilStop *	5.6 kg/2,000 L water/ha	0	***Oidium lycopersici*** Start application at first sign of disease. Uniform and complete coverage of the foliage is essential for the most effective results. Number of applications will depend on disease pressure. Use 7-day intervals between applications. Maximum number of applications per season is 10. Do not apply through any type of irrigation system. **REI: 4 hr**
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	425–840 g/ 700 L water/ha	NS	***Leveillula taurica, Oidium lycopersici*** For suppression. Make the first application when conditions are conducive to disease development and repeat application every 7–14 days. Use the shorter application interval under high disease pressure. Spray to wet, but avoid run-off. **REI: Do not enter treated area until spray is dried.**
P5	*Reynoutria sachalinensis* extract	Regalia Maxx *	0.125%–0.25% v/v (1.25–2.5 mL/L) water	0	***Leveillula taurica, Oidium neolycopersici*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat as necessary on a 7–10-day interval. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L/ha. **REI: Do not enter treated area until spray is dried.**
SEPTORIA LEAF SPOT					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	***Septoria lycopersici*** Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
M3	mancozeb	Manzate 200 WP	2.25 kg/ha	7	Apply every 7–12 days to keep new growth covered. **REI: NS**
		Manzate DF	2.4 kg/ha		Apply every 7–12 days to keep new growth covered. **REI: 24 hr**
		Manzate Pro-Stick			

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant	1	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. A maximum of 4 applications can be made per crop cycle. Do not apply more than 2 seeding/seedling applications per crop cycle. Do not apply more than 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilils* strain MBI 600	Serifel	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
M4	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
NC	garlic powder	Influence WP	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Do not enter treated area until spray is dried.**
	Gliocladium catenulatum strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Streptomyces strain K61	Mycostop WP	See **Remarks.**	NS	***Fusarium* spp.** For suppression. Apply immediately after transplanting. Repeat applications at 3–6 week intervals. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	1	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. A maximum of 4 applications can be made per crop cycle. Do not apply more than 2 seeding/seedling applications per crop cycle. Do not apply more than 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
M4	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
NC	garlic powder	Influence WP	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Do not enter treated area until spray is dried.**
	Gliocladium catenulatum strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates:** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Streptomyces strain K61	Mycostop WP	See **Remarks.**	NS	***Fusarium* spp., *Phytophthora* spp.** For suppression. Apply immediately after transplanting. Repeat applications at 3–6-week intervals. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates:** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
NC (cont'd)	*Trichoderma harzianum* Rifai strain KRL-AG2	RootShield Granules *	600–750 g/m³ (loose) planting mix or soil	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. For best results, thoroughly incorporate granules during mix preparation or pot filling, or incorporate into planting beds by raking or tilling. **REI: 4 hr**
		RootShield HC *	**Drench:** 55–110 g/m³ using a suspension of 30–45 g/100 L	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: 4 hr**
		RootShield WP *			
	Trichoderma harzianum Rifai strain T-22	Trianum G	See **Remarks.**	NS	***Fusarium oxysporum*** For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. **REI: NS** **Rates:** **Before filling seed trays or containers:** 750 g/m³ **Subsequent applications at transplanting or repotting:** 375 g/m³ **Crops on substrate, when transplanting:** 1 g/planting hole
		Trianum P	See **Remarks.**	NS	***Fusarium oxysporum*** For suppression. Sowing application method: For the best results, begin use from propagation onwards, before occurrence of disease. Transplanting high crop density: Use a water volume equivalent to 10% of the substrate volume or 2–5 L/m². Low crop density: Use a water volume equivalent to 10% of the substrate volume or 100 L/1,000 plants. **REI: NS** **Rates:** **Sowing:** 1.5 g/m² of cultivated area, suspended in 2.5–5 L water **Transplanting high crop density:** 3 g/m² of cultivated area (1.5 g/m² if plants have been treated previously) **Transplanting low crop density:** 30 g/1,000 plants (15 g/1,000 plants if plants have been treated previously).

[1] See Appendix G for FRAC group definitions.

5. Cucumbers

Products registered for greenhouse cucumber insect and mite pests are listed in Table 5–1.
Products registered for greenhouse cucumber diseases are listed in Table 5–2.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval
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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m^2). Thoroughly ventilate premises before re-entering on the day following treatment. **REI: 24 hr**
	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	16 g/80 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not apply more than once per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
9B	pymetrozine	Endeavor 50 WG	100–200 g (50–100 g a.i.) in a minimum of 1,000 L water/ha	3	**Green peach aphid (*Myzus persicae*), melon aphid (*Aphis gossypii*)** Do not exceed 2 applications per crop cycle or 3 applications/yr in greenhouses with multiple crop cycles. Apply as a foliar spray. Do not re-apply for at least 7 days. On hard-to-wet plants, add a non-ionic or organosilicone-based surfactant to improve coverage. **REI: 12 hr**
23	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate per single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L/ha (42 mL concentration) to 1,000 L/ha (30 mL concentration). Use the higher concentration for higher pest infestation levels. Interval between applications is at least 7–14 days. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
29 (formerly 9C)	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 12.5 mg/plant	0	Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Allow a minimum of 7 days between applications. Do not apply more than 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L/ha. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
NC	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB Bio-Ceres G WP	2–4 g/L water	0	Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L of spray volume will typically be required for 1 ha. This product is most effective when used early, before high insect populations develop. Re-apply as necessary within a 7-day interval. In case of pest outbreak, the product can be used every 3–5 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Do not re-enter into treated areas until the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5 day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	Deters feeding. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
BANANA MOTH (*Opogona sacchari*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.8 kg/1,000 L water	0	Foliar application. Make application just prior to egg hatch. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stems is necessary (minimum of 300 L water/ha). Re-apply at 7-day intervals, as required by monitoring. **REI: NS**
		Bioprotec CAF *	1.6 L/1,000 L water		

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BEET ARMYWORM (*Spodoptera exigu*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage, but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter into treated areas until the spray has dried.**
CORN EARWORM (TOMATO FRUITWORM) (*Helicoverpa* (=*Heliothis*) *zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage, but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter into treated areas until the spray has dried.**
DUPONCHELIA FOVEALIS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	625 g/1,000 L	0	Make applications when egg hatch is essentially complete, when larvae are small, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.8 kg/1,000 L water	0	Foliar application. Make application when egg hatch is essentially complete, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well, and into the top layer of the soil around the base of the plant. Thorough coverage of foliage and stems is necessary. Re-apply at 7-day intervals, as required by monitoring. **REI: NS**
		Bioprotec CAF *	1.6 L/1,000 L water		
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
EUROPEAN CORN BORER (*Ostrinia nubilalis*)					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	30 g/1,000 L water	2	Maximum application volume that can be used is 2,000 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L water **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
LEAFMINERS					
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	***Liriomyza* spp.** Application should be made preferably in 2,000–4,000 L water/ha. Do not apply more than 1,200 mL or less than 600 mL product/ha per application. Use in sufficient water to obtain uniform coverage. Make no more than 5 applications per crop cycle. Apply no more than 6,000 mL product/ha per crop cycle. Do not apply through any type of irrigation system. **REI: Do not re-enter into treated areas until the spray has dried.**
LEAFROLLERS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including 1 postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 1,000 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	240 mL/1,000 L water		
		Success	120 mL/1,000L water		
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	75–150 g/250 L	0	**Alfalfa looper (*Autographa californica*), Cabbage looper (*Trichoplusia ni*), *Chrysodeixis* spp.** Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use a rate at the higher end of the range. Repeat applications at an interval to maintain control, usually 3–14 days. **REI: NS**
		Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m^2)	NS	**Cabbage looper (*Trichoplusia ni*)** Apply using a high volume spray. Apply at 10-day interval when loopers first appear. In general, larvae should be treated when they are newly hatched. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.92 kg/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
		Bioprotec CAF *	1.8 L/1,000 L water		
	Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter into treated areas until the spray has dried.**
28	chlorantraniliprole	Coragen	125 mL/1,000 L	1	**Cabbage looper (*Trichoplusia ni*)** Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Repeat applications if monitoring indicates it is necessary. Do not make more than 3 applications per crop cycle. Do not apply more than once every 7 days. Do not exceed a total of 750 mL product/ha per crop cycle. The maximum finished spray volume is 2,000 L/ha. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex	50–200 mL/400 L water	0	**Cabbage looper (*Trichoplusia ni*)** Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days if monitoring indicates that it is necessary. **REI: Do not allow worker entry into treated areas until mists have settled.**

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Table 5–1. Products registered for greenhouse cucumber insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LYGUS BUGS (TARNISHED PLANT BUG)					
29 (formerly 9C)	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 12.5 mg/plant	0	Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Allow a minimum of 7 days between applications. Do not apply more than 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L/ha. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**
MEALYBUGS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
1B	naled	Dibrom	9.6 mL/100 m^3	2	**Two-spotted spider mite (*Tetranychus urticae*)** Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	**Two-spotted spider mite (*Tetranychus urticae*)** Application should be made preferably in 2,000–4,000 L water/ha. Do not apply more than 1,200 mL or less than 600 mL product/ha per application. Use in sufficient water to obtain uniform coverage. Make no more than 5 applications per crop cycle. Apply no more than 6,000 mL product/ha per crop cycle. Do not apply through any type of irrigation system. **REI: Do not re-enter treated areas until residues have dried.**
12B	fenbutatin oxide	Vendex 50W Vendex 50WP	50 g/100 L water	3	**Two-spotted spider mite (*Tetranychus urticae*)** Begin applications when mites appear and repeat as necessary to maintain control. Thorough coverage of all foliage, especially the under-surface of leaves, is essential. The addition of a suitable spreader-sticker will usually result in superior mite control. Not highly injurious to beneficial mites and is non-toxic to honeybees. **REI: 12 hr; 48 hr for high foliar-contact activities**
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage. Thorough coverage is essential for effective control. Actual spray volume will vary, depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Allow a minimum of 21 days between applications. Do not apply more than a maximum of 2 applications per crop (0.69 kg a.i./ha). **REI: 12 hr**
21A	pyridaben	Dyno-Mite WP SanMite WP	284 g/1,000 L water/ha	2	**Two-spotted spider mite (*Tetranychus urticae*)** Maximum number of applications per crop cycle is 2. Apply at intervals of at least 28 days. Do not apply this product through any type of irrigation system. Do not apply as a fog. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Two-spotted spider mite (*Tetranychus urticae*)** Under high pest population pressure, re-apply in 10–14 days as required by monitoring. Do not apply more than 2 applications per crop cycle. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
NC	*Metarhizium anisopliae* strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter into treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	For suppression. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**
UN	bifenazate	Floramite SC	125 mL (30 g a.i.)/ 400 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Maximum number of sprays per crop cycle is 2. Make only 1 application of this product before rotating to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PSYLLIDS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**
SLUGS & SNAILS					
NC	ferric phosphate	Sluggo *	1.2–5 g/m^2	NS	***Deroceras* spp., *Arion* spp., *Helix* spp.** Re-apply as the bait is consumed or at least every 2 weeks if slugs and snails continue to be a problem. **REI: NS**
THRIPS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	30 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Maximum application volume that can be used is 2,000 L/ha. Apply when western flower thrips first appears. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
29 (formerly 9C)	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 12.5 mg/plant	0	Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Allow a minimum of 7 days between applications. Do not apply more than 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L/ha. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
THRIPS (cont'd)					
NC	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB Bio-Ceres G WP	2–4 g/L water	0	Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L of spray volume will typically be required for 1 ha. This product is most effective when used early, before high insect populations develop. Re-apply as necessary within a 7-day interval. In case of pest outbreak, the product can be used every 3–5 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Do not re-enter into treated areas until the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	500–1,000 g/400 L	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L **Drench:** 108 mL/10 L	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Do not re-enter into treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	For suppression. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.46–0.92 kg/ 1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
		Bioprotec CAF *	0.9–1.8 L/1,000 L water		

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m^2). Thoroughly ventilate premises before re-entering on the day following treatment. **REI: 24 hr**
	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Maximum of 3 applications per crop cycle (including one postharvest). Minimum 7-day spray interval. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
3A	permethrin	Ambush 50 EC	20 mL/100 L water	1	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Apply to cover all foliage thoroughly. Repeat application as necessary to maintain control. **REI: NS**
		Pounce 384 EC	260 mL/1,000 L water	1	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Apply to cover all foliage thoroughly. Repeat application as necessary to maintain control. **REI: Re-entry into treated areas is permissible as soon as the spray deposit has dried.**
4A	imidacloprid	Intercept 60 WP	16 g/80 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not apply more than once per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
7C	pyriproxyfen	Distance	45 mL/100 L water	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. If necessary, make a second application from 14–28 days after the first application. Use longer interval when plants are not growing rapidly. Apply a maximum of 2 applications per cropping cycle. If the cropping cycle is less than 6 months, do not apply more than 2 applications per 6 months. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Under high pest population pressure, re-apply in 10–14 days as required by monitoring. Do not apply more than 2 applications per crop cycle. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate per single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L/ha (42 mL concentration) to 1,000 L/ha (30 mL concentration). Use the higher concentration for higher pest infestation levels. Interval between applications is at least 7–14 days. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
29 (formerly 9C)	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 12.5 mg/plant	0	Suppression only for foliar application. Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Allow a minimum of 7 days between applications. Do not apply more than 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L/ha. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**
NC	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB Bio-Ceres G WP	2–4 g/L water	0	Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L of spray volume will typically be required for 1 ha. This product is most effective when used early, before high insect populations develop. Re-apply as necessary within a 7-day interval. In case of pest outbreak, the product can be used every 3–5 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Do not re-enter into treated areas until the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter into treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	Deters feeding. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
NC (cont'd)	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning, evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 100 parts water	0	Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ALTERNARIA LEAF BLIGHT (*Alternaria cucumerina*)					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L water/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
ANTHRACNOSE (*Colletotrichum orbiculare*)					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L water/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
ANGULAR LEAF SPOT (*Pseudomonas syringae* pv. *orbiculare*)					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L water/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL WILT (*Erwinia tracheiphila*)					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L water/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
CERCOSPORA LEAF SPOT (*Cercospora citrullina*)					
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat as necessary on 7–10-day intervals. Thorough coverage is essential. **REI: NS**
DOWNY MILDEW (*Pseudoperonospora cubensis*)					
28	propamocarb hydrochloride	Previcur N	1.5 L/ha	2	For suppression. Apply foliar treatment when plants begin to vine or when conditions first become favourable for disease development, but before infection. Make a maximum of 1 application per crop cycle. **REI: 12 hr**
33	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–5 L/ha in a minimum of 100 L water	1	For suppression. Use a maximum of 6 foliar applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
40	mandipropamid	Revus	400 mL/ha with 1.5 L/ha of Previcur N	2	Apply as a resistance management tool in a tank mix as a foliar application when plants begin to vine or when disease threatens. Do not make more than 1 application per crop cycle. Do not apply by chemigation. Apply to transplants only after they have been planted in the field. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
DOWNY MILDEW (*Pseudoperonospora cubensis*) (cont'd)					
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat as necessary on 7–10-day intervals. Thorough coverage is essential. **REI: NS**
46	tea tree oil	Timorex Gold *	2–8 L/400–800 L water/ha	2	For suppression. Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventative treatments, apply at 7–14-day intervals, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
NC	citric and lactic acid	Cyclone	8% dilution in water solution	NS	For suppression. Apply prior to, or at the early stages of disease development. Apply as foliar spray until runoff. Interval of application is 7–10 days. Can leave white hydrosoluble residues on treated crop. Use of surfactant Liberate and LI700 can help achieve better coverage of leaves and better efficacy. **REI: Do not re-enter until sprays have dried.**
	garlic powder	Influence WP	6.9 kg/1,000 L water/ha	0	May inhibit symptoms when used in conjunction with integrated pest management strategies. Spray the foliage and substrate surface. Ensure thorough coverage. Repeat applications at 7–14-day intervals. **REI: Do not re-enter until sprays have dried.**
P5	*Reynoutria sachalinensis* extract	Regalia Maxx *	0.25% v/v (2.5 mL/L water)	0	For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat as necessary on a 7–10-day interval. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L/ha. **REI: Do not re-enter until sprays have dried.**
U15	oxathiapiprolin	Orondis	0.0875–0.35 L/ha	0	Foliar application only. Begin applications prior to disease development and continue on a 5–14-day interval Use the higher end of the rate range and shorter interval when disease pressure is high or for susceptible varieties. Do not make more than 4 applications/yr. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*)					
2	iprodione	Rovral WP	100 g/100 L water/ha	2	Spray to run-off ensuring good coverage of the plants, particularly stem nodes, immediately following any pruning. Begin application at the first sign of disease. **REI: 12 hr**
		Rovral WDG	100 g/100 L water		
7	penthiopyrad	Fontelis	1–1.5 L/ha	1	Begin applications prior to disease development. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
9	pyrimethanil	Scala SC	2 L/ha	1	Apply at first sign of disease. Spray volumes will vary depending on crop canopy height. Use appropriate spray volume to ensure thorough coverage of leaf canopy and stems. A minimum of 485 L/ha for smaller plants, increasing to 1,000–2,500 L/ha for larger plants. Repeat applications should be made on a 7–14-day interval depending on disease conditions. Do not apply more than 2 applications per growing season. Do not apply more than 1 application before alternating with a fungicide with a different mode of action. Ventilate for at least 2 hr after application. Proper ventilation after spraying is essential to avoid brown or necrotic spots that can be caused by the vapour activity of Scala SC. **REI: 24 hr**
17	fenhexamid	Decree 50 WDG	**Small plants:** 1.5 kg/ha (0.75 kg a.i./ha)	1	Apply in a spray volume of approximately 500 L (small plants) to 1,500 L (large/mature plants). Begin applications when conditions favour disease development. Do not make more than 2 applications per crop cycle. **REI: 4 hr**
M3	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	1	Apply at weekly intervals. Causes severe injury to seedless English cucumbers. **REI: Do not re-enter until sprays have dried.**
NC	*Gliocladium catenulatum* strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate to high disease pressure. **REI: 4 hr**
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield HC *	3.75–7.5 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet, but avoid run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GUMMY STEM BLIGHT (*Didymella bryoniae*)					
2	iprodione	Rovral WP Rovral WDG	100 g/100 L water	2	Apply label rate using 1,000–2,000 L water/ha. Spray to run-off ensuring good coverage of the plants, particularly stem nodes, immediately following any pruning. Begin application at the first sign of disease. **REI: 12 hr**
3	myclobutanil	Nova WSP	340 g/ha	2	Use a maximum of one application per crop cycle. Apply when disease first appears. **REI: 12 hr**
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat as necessary on 7–10-day intervals. Thorough coverage is essential. **REI: NS**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3 kg in a minimum of 250 L water/ha	0	For suppression. Apply when conditions favour disease development. Do not apply this product using any type of foggers or misters. Do not apply more than once per crop cycle. Do not use on plants that will be transplanted. **REI: Do not re-enter until sprays have dried.**
NC	*Gliocladium catenulatum* strain J1446	Prestop *	1% aqueous suspension (50 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate to high disease pressure. **REI: 4 hr**
PHYTOPHTHORA FOLIAR BLIGHT					
33	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–6 L/ha in a minimum of 100 L water	1	***Phytophthora capsici, P. nicotianae*** For suppression. Use a maximum of 6 foliar applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
U15	oxathiapiprolin	Orondis	0.175–0.35 L/ha	0	***Phytophthora capsici*** Foliar application only. Begin applications prior to disease development and continue on a 5–14-day interval. Use the higher end of the rate range and shorter interval when disease pressure is high. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW					
3	myclobutanil	Nova WSP	340 g/ha	2	Use a maximum of 1 application per crop cycle. Apply when disease first appears. **REI: 12 hr**
7	penthiopyrad	Fontelis	1.25 L/ha	1	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** Begin applications prior to disease development. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	**Foliar:** 1–2.5 kg/ha **Low disease pressure:** 0.5–1 kg/ha	0	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply from fruit formation to end of maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not re-enter until sprays have dried.**
		Double Nickel LC	**Foliar:** 5–12.5 L/ha **Low disease pressure:** 2.5–5 L/ha		
	Bacillus subtilis strain QST 713	Cease / Rhapsody ASO	1–2 L/100 L water	0	***Erysiphe* spp., *Sphaerotheca* spp.** For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat as necessary on 7–10-day intervals. Thorough coverage is essential. **REI: NS**
46	tea tree oil	Timorex Gold *	2–8 L in 400–800 L water/ha	2	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, apply at 7–14-day intervals, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3 kg in a minimum of 250 L water/ha	0	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply when conditions favour disease development. Do not apply this product using any type of foggers or misters. Do not apply more than once per crop cycle. Do not use on plants that will be transplanted. **REI: Do not re-enter until sprays have dried.**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 200–3,000 L water/ha	1	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Do not make more than 3 applications per crop cycle. First application should be made when disease first appears; a second application should be made 7–10 days later. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. The third application can be made at a 7–10-day interval if conditions remain favourable for disease development. **REI: 24 hr**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
M2	sulphur	Kumulus DF *	120 g/100 L water	1	Apply once every 5 days as required. Do not apply more than 8 applications per season. Do not apply if temperature is above 27°C (in shade) and high humidity prevails or is expected within 3 days after the treatment. Do not apply under intense sunshine. **REI: 24 hr**
		Microscopic Sulphur WP *	105 g/100 L water	1	Apply at weekly intervals as needed. Do not make more than 8 applications per season. Do not apply if high temperatures (above 25°C) and high humidity prevail or are expected during the 3 days following application. **REI: 24 hr**
		Microthiol Disperss *	120 g/100 L water	1	Apply when disease first appears and repeat every 5 days as necessary. Do not apply more than 8 applications per season. Do not apply under intense sunshine. Do not apply if temperature will exceed 27°C (in shade) and high humidity prevails within 3 days following spraying, due to the risk of crop injury. **REI: 24 hr**
NC	citric and lactic acid	Cyclone	1.2% dilution in water solution	NS	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply prior to, or at the early stages of disease development. Apply as foliar spray in sufficient spray volume to ensure thorough coverage. Interval of application is 7–10 days. Can leave white hydrosoluble residues on treated crop. Use of surfactant Liberate and LI700 can help achieve better coverage of leaves and better efficacy. **REI: Do not re-enter until sprays have dried.**
	garlic powder	Influence LC	1.8% with high volume sprayer **Tank mix:** 0.45% with Cyclone at 0.3% without surfactant	0	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply preventively or at first signs of disease. Repeat applications at 7–10-day intervals. Ensure thorough coverage of foliage. Do not exceed 18 L/ha. Do not use with ultra low volume sprayers. **REI: Do not re-enter until sprays have dried.**
		Influence WP	6.9 kg/1,000 L water/ha	0	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Spray the foliage and substrate surface. Ensure thorough coverage. Repeat applications at 7–14-day intervals. **REI: Do not re-enter until sprays have dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Apply at 7–14-day intervals. For effective control thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium bicarbonate	MilStop *	5.6 kg/2,000 L water/ha	0	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** Start application at first sign of disease. Uniform and complete coverage of the foliage is essential for the most effective results. Number of applications will depend on disease pressure. Use 7-day intervals between applications. Maximum 10 applications per season. Do not apply through any type of irrigation system. **REI: 4 hr**
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	420 g/470–800 L water/ha	NS	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Make the first application when conditions are conducive to disease development and repeat application every 7–14 days. Use the shorter application interval under high disease pressure. Spray to wet, but avoid run-off. **REI: Do not enter treated area until spray is dried.**

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
P5	*Reynoutria sachalinensis* extract	Regalia Maxx *	0.125%–0.25% v/v (1.25–2.5 mL/L) water	0	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat as necessary on a 7–10-day interval. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L/ha. **REI: Do not re-enter until sprays have dried.**
SEPTORIA LEAF SPOT					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	***Septoria cucurbitacearum*** Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. A maximum of 4 applications can be made per crop cycle. Do not apply more than 2 applications per crop cycle to seeding beds or seedlings. Do not apply more than 2 applications per crop cycle after-transplanting. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant-growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
NC	garlic powder	Influence WP	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Do not re-enter until sprays have dried.**
	Gliocladium catenulatum strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a growing medium treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate to high disease pressure. **REI: 4 hr** **Rates** **Growing media:** 125–250 mL suspension/10 L growing media **Soil drench:** 20 L suspension/m^3 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
NC (cont'd)	*Streptomyces* strain K61	Mycostop WP	See **Remarks.**	NS	***Fusarium* spp., *Pythium* spp.** For suppression. Apply immediately after transplanting. Repeat applications at 3–6-week intervals. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain T-22	Trianum G	See **Remarks.**	NS	***Pythium ultimum*** For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. **REI: NS** **Rates** **Before filling seed trays or containers:** 750 g/m^3 **Subsequent applications at transplanting or repotting:** 375 g/m^3 **Crops on substrate, when transplanting:** 1 g per planting hole
		Trianum P	See **Remarks.**	NS	***Pythium ultimum*** For suppression. Sowing application method: For the best results, begin use from propagation onwards, before occurrence of disease. Transplanting high crop density: Use a water volume equivalent to 10% of the substrate volume or 2–5 L/m^2. Low crop density: Use a water volume equivalent to 10% of the substrate volume or 100 L/1,000 plants. **REI: NS** **Rates** **Sowing:** 1.5 g/m^2 of cultivated area, suspended in 2.5–5 L water **Transplanting high crop density:** 3 g/m^2 of cultivated area (1.5 g/m^2 if plants have been treated previously) **Transplanting low crop density:** 30 g/1,000 plants (15 g/1,000 plants if plants have been treated previously)

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
4	metalaxyl-M	Ridomil Gold 480 EC Ridomil Gold 480 SL	250 mL of solution (0.75–1.25 mL/10 L water) to base of each plant	21	***Pythium* spp.** Apply once per crop cycle, immediately after transplanting as a drench to the growing media at the base of each plant. Do not use in the propagation house. Do not apply to cucumbers intended for transplant out to fields. Do not apply to cucumbers grown in soil. **REI: 12 hr**
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. A maximum of 4 applications can be made per crop cycle. Do not apply more than 2 seeding/seedling applications per crop cycle. Do not apply more than 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant-growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
NC	garlic powder	Influence WP	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Do not re-enter until sprays have dried.**
	Gliocladium catenulatum strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water) to 1% aqueous suspension (50 g/5 L water) See **Remarks.**	NS	***Fusarium oxysporum; Pythium* spp.** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
NC (cont'd)	*Streptomyces* strain K61	Mycostop WP	See **Remarks.**	NS	***Fusarium* spp.** For suppression. Apply immediately after transplanting. Repeat applications at 3–6-week intervals. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield Granules *	600–750 g/m^3 (loose) planting mix or soil	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. For best results, thoroughly incorporate granules during mix preparation or pot filling, or incorporate into planting beds by raking or tilling. **REI: 4 hr**
		RootShield HC *	**Drench:** 55–110 g/m^3 using a suspension of 30–45 g/100 L	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: 4 hr**
		RootShield WP *			***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: NS**
	Trichoderma harzianum Rifai strain T-22	Trianum G	See **Remarks.**	NS	***Pythium aphanidermatum*** For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. **REI: NS** **Rates** **Before filling seed trays or containers:** 750 g/m^3 **Subsequent applications at transplanting or repotting:** 375 g/m^3 **Crops on substrate, when transplanting:** 1 g/planting hole

[1] See Appendix G for FRAC group definitions.

6. Peppers

Products registered for greenhouse pepper insect and mite pests are listed in Table 6–1.
Products registered for greenhouse pepper diseases are listed in Table 6–2.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable
* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	acetamiprid	Tristar 70 WSP	3 water soluble packs/ 1,000 L water	3	Do not exceed 5 water soluble packs (1,667 L of spray solution)/ha. Do not make more than 2 applications/yr. Do not re-apply more than once every 7 days. **REI: 12 hr**
	imidacloprid	Intercept 60 WP	**Mature plants:** 16 g/70 L water/ 1,000 plants **Transplant tray plug drench:** 4.1 g/1,000 seedling plants	3	**Green peach aphid (*Myzus persicae*)** For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Irrigate moderately but thoroughly after application, allowing no leaching and runout from container for at least 10 days after application. Do not apply more than once per season. Mature plants: applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. Transplants: Apply to 2–3-week-old seedlings in flats at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m^2 of seedling trays. May harm pollinators and certain beneficial insects. **REI: NS**
9B	pymetrozine	Endeavor 50 WG	100–200 g in a minimum of 1,000 L water/ha	3	**Green peach aphid (*Myzus persicae*), melon aphid (*Aphis gossypii*)** Do not apply more than 200 g in 1,000 L per application. Do not exceed 2 applications per crop cycle or 3 applications/yr in greenhouses with multiple crop cycles. Apply as a foliar spray. Do not re-apply for at least 7 days. On hard-to-wet plants, add a non-ionic or organosilicone-based surfactant to improve coverage. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
23	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate/single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L/ha (42 mL concentration) to 1,000 L/ha (30 mL concentration). Use the higher concentration for higher pest infestation levels. Interval between applications is at least 7–14 days. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal, and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	2 L/100 L water applying 250 L/4,000 m²	0	Make applications bi-monthly or when aphids reach treatment levels using concentrated high-volume power sprayers. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L and apply 250 L spray solution/ 4,000 m²	1	Make applications bi-monthly or when aphids reach treatment levels using concentrated high volume power sprayers. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BANANA MOTH (*Opogona sacchari*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.8 kg/1,000 L water	0	Foliar application. Make application just prior to egg hatch. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stems is necessary (minimum of 300 L water/ha). Re-apply at 7-day intervals, as required by monitoring. **REI: NS**
		Bioprotec CAF *	1.6 L/1,000 L water		
BEET ARMYWORM (*Spodoptera exigu*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray is dried.**
CORN EARWORM (TOMATO FRUITWORM) (*Helicoverpa (=Heliothis) zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray is dried.**
DUPONCHELIA FOVEALIS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	625 g/1,000 L water	0	Make applications when egg hatch is essentially complete when larvae are small but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. Apply every 7 days as required by monitoring. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.8 kg/1,000 L water		
		Bioprotec CAF *	1.6 L/1,000 L water		
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
EUROPEAN CORN BORER (*Ostrinia nubilalis*)					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	30 g/1,000 L water	2	Maximum application volume that can be used is 2,000 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
18	tebufenozide	Confirm 240F	0.6 L/400 L water/ha	3	Good spray coverage is essential for control. Apply at intervals of at least 7 days. Do not exceed 4 applications/yr. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LEAFMINERS					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Tomato leafminer (*Tuta absoluta*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray is dried.**
	Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	500–1,000 g/1,000 L water	0	**Lepidopteran leafminers** Apply at egg hatch. Thorough coverage of foliage and stems is necessary. Apply every 7–10 days as required by monitoring. **REI: NS**
18	tebufenozide	Confirm 240F	0.6 L/ha	3	**Lepidopteran leafminers** For suppression. Foliar application only. Use a high-volume sprayer. Apply at first egg hatch. Make a maximum of 4 applications per crop cycle, if monitoring indicates it is required. Applications should be made a minimum of 10 days apart. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
28	chlorantraniliprole	Coragen	200 mL/1,000 L water	1	**Lepidopteran leafminers** Apply at egg hatch. Re-apply if monitoring indicates it is necessary. Thorough coverage is important to obtain optimum control. Do not make more than 3 applications per crop cycle. Do not apply more than once every 7 days. Do not exceed a total of 750 mL product/ha per crop cycle. Apply in a maximum finished spray volume of 1,250 L/ha. **REI: 12 hr**
LEAFROLLERS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 1,000 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	240 mL/1,000 L water		
		Success	120 mL/1,000 L water		
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	75–150 g/250 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use the higher rate range. Repeat applications at an interval to maintain control, usually 3–14 days. Maximum of 4 applications per season. **REI: NS**
		DiPel WP	150–300 g/250 L water/ 4,000 m^2	NS	**Cabbage looper (*Trichoplusia ni*)** Apply to upper and lower portions of the leaves to run-off. Repeat applications will be necessary if a new hatch occurs. **REI: NS**
		Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m^2)	NS	**Cabbage looper (*Trichoplusia ni*)** Apply using a high volume spray. Apply at 10-day interval when loopers first appear. In general, larvae should be treated when they are newly hatched. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.92 kg/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
		Bioprotec CAF *	1.8 L/1,000 L water		
	Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray is dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	**Alfalfa looper (*Autographa californica*), Cabbage looper (*Trichoplusia ni*)** For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**

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Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
18	tebufenozide	Confirm 240F	0.6 L (140 g a.i.)/ 400 L water/ha	3	**Cabbage looper (*Trichoplusia ni*)** Foliar application only. Make a maximum of 4 applications per crop cycle. Applications should be made a minimum of 7 days apart. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
28	chlorantraniliprole	Coragen	125 mL/1,000 L water	1	**Cabbage looper (*Trichoplusia ni*)** Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Repeat applications if monitoring indicates it is necessary. Do not make more than 3 applications per crop cycle. Do not apply more than once every 7 days. Do not exceed a total of 750 mL product/ha per crop cycle. The maximum finished spray volume is 2,000 L/ha. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex	50–200 mL/400 L water	0	**Cabbage looper (*Trichoplusia ni*)** Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days if monitoring indicates that it is necessary. **REI: Do not re-enter treated areas until the spray is dried.**
MEALYBUGS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**

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Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	**Two-spotted spider mite (*Tetranychus urticae*)** Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	**Two-spotted spider mite (*Tetranychus urticae*)** Application should be made, preferably in 2,000–4,000 L water/ha. Do not apply more than 1,200 mL or less than 600 mL product/ha per application. Use in sufficient water to obtain uniform coverage. Application is limited to between February and October and/or when daily light intensity in the greenhouse is at levels higher than 700 joules per cm^2 per day. Make no more than 5 applications per crop cycle. Apply no more than 6,000 mL product/ha per crop cycle. Do not apply through any type of irrigation system. **REI: Do not re-enter treated areas until the spray is dried.**
13	chlorfenapyr	Pylon	20–30 mL/100 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage. Thorough coverage is essential for effective control. Actual spray volume will vary depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Allow a minimum of 21 days between applications. Do not apply more than a maximum of 2 applications per crop (0.69 kg a.i./ha). **REI: 12 hr**
21A	pyridaben	Dyno-Mite WP SanMite WP	284 g/1,000 L water/ha	3	**Two-spotted spider mite (*Tetranychus urticae*)** Maximum number of applications per crop cycle is 2. Apply when mites first appear and before the threshold of 5 mites per leaf is reached. Do not apply this product through any type of irrigation system. Do not apply as a fog. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Two-spotted spider mite (*Tetranychus urticae*)** Under high pest population pressure, re-apply in 10–14 days as required by monitoring. Do not apply more than 2 applications per crop cycle. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
NC	*Metarhizium anisopliae* strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray is dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	For suppression. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Apply once weekly for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**
UN	bifenazate	Floramite SC	125 mL (30 g a.i.)/ 400 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Maximum number of sprays per crop cycle is 2. Make only 1 application of this product before rotating to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PEPPER WEEVIL (*Anthonomus eugenii*)					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	thiamethoxam	Flagship WG	14 g/100 L water	1	For suppression. Apply before pests reach damaging levels. Apply in sufficient water volume to ensure thorough coverage, up to a maximum of 2,000 L/ha. Maximum of 3 applications per crop cycle. Application interval is 7 days. Toxic to bees and other beneficial insects. Avoid application when bees or other beneficial insects are actively visiting the treatment area. **REI: 12 hr**
PSYLLIDS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	**Tomato psyllid (*Bactericerca cockerelli*)** Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	**Tomato psyllid (*Bactericerca cockerelli*)** Application should be made preferably in 2,000–4,000 L water/ha. Do not apply more than 1,200 mL or less than 600 mL product/ha per application. Use in sufficient water to obtain uniform coverage. Application is limited to between February and October and/or when daily light intensity in the greenhouse is at levels higher than 700 joules/cm^2 per day. Make no more than 5 applications per crop cycle. Apply no more than 6,000 mL product/ha per crop cycle. Do not apply through any type of irrigation system. **REI: Do not re-enter treated areas until the spray is dried.**
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
SLUGS & SNAILS					
NC	ferric phosphate	Sluggo *	1.2–5 g/m²	NS	***Deroceras* spp., *Arion* spp., *Helix* spp.** Re-apply as the bait is consumed or at least every 2 weeks if slugs and snails continue to be a problem. **REI: NS**
THRIPS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	30 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Maximum application volume that can be used is 2,000 L/ha. Apply when western flower thrips first appears. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water **Drench:** 108 mL/10 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Do not re-enter treated areas until the spray is dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	For suppression. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
TOBACCO BUDWORM (*Heliothis virescens*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray is dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.46–0.92 kg/1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
		Bioprotec CAF *	0.9–1.8 L/1,000 L water		
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	**Mature plants:** 16 g/70 L water/1,000 plants **Transplant tray plug drench:** 4.1 g/1,000 seedling plants	3	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Irrigate moderately but thoroughly after application, allowing no leaching and run-out from container for at least 10 days after application. Do not apply more than once per season. Mature plants: applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. Transplants: Apply to 2–3 week-old seedlings in flats at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m^2 of seedling trays. May harm pollinators and certain beneficial insects. **REI: NS**
7C	pyriproxyfen	Distance	45 mL/100 L water	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. If necessary, make a second application from 14–28 days after the first application. Use longer interval when plants are not growing rapidly. Apply a maximum of 2 applications per cropping cycle. If the cropping cycle is less than 6 months, do not apply more than 2 applications per 6 months. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Under high pest population pressure, re-apply in 10–14 days as required by monitoring. Do not apply more than 2 applications per crop cycle. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate per single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L/ha (42 mL concentration) to 1,000 L/ha (30 mL concentration). Use the higher concentration for higher pest infestation levels. Interval between applications is at least 7–14 days. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray is dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	Deters feeding. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 100 parts water	0	Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2 week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BACTERIAL CANKER (*Clavibacter michiganensis* subsp. *michiganensis*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not make more than 3 applications per season. A minimum interval of 7 days between applications is required. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL SPECK (BACTERIAL BLIGHT) (*Pseudomonas syringae* pv. *tomato*)					
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin application soon after emergence or transplant and when conditions are conducive to disease development. Repeat as necessary on a 7–10-day interval. **REI: NS**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL SPOT (BACTERIAL LEAF SPOT) (*Xanthomonas campestris* pv. *vesicatoria*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not make more than 3 applications per season. A minimum interval of 7 days between applications is required. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin application soon after emergence or transplant and when conditions are conducive to disease development. Repeat as necessary on a 7–10-day interval. **REI: NS**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
EARLY BLIGHT (*Alternaria solani*)					
7	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	For suppression. Begin applications prior to disease development. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55 Double Nickel LC	0.5–2 kg/ha 2.5–10 L/ha	0	Apply from flowering to fruiting. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not re-enter until sprays have dried.**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*)					
7	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	Begin applications prior to disease development. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
17	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.75 kg a.i./ha)	1	Begin application when conditions favour disease development. Do not make more than 3 applications per crop cycle. **REI: 4 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	**Foliar:** 1.25–3.6 kg/ha **Low disease pressure:** 0.9–1 kg/ha	0	For suppression. Use from flowering to fruit maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not re-enter until sprays have dried.**
		Double Nickel LC	**Foliar:** 6.25–18 L/ha **Low disease pressure:** 4.5–5 L/ha		
	Bacillus subtilis strain QST 713	Cease	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat as necessary on a 7–10-day interval. **REI: NS**
		Rhapsody ASO			
NC	*Gliocladium catenulatum* strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr**
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield HC *	3.75–7.5 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet, but avoid run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LATE BLIGHT (PHYTOPHTHORA BLIGHT, PHYTOPHTHORA FOLIAR BLIGHT)					
33	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha in a minimum of 100 L water	1	***Phytophthora* spp., *Phytophthora infestans*** For suppression. Use a maximum of 5 foliar and/or irrigation applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	***Phytophthora infestans*** Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
21	cyazofamid	Torrent 400 SC	25 mL/100 L water	0	***Phytophthora capsici*** Make the first application of the solution as a soil drench to thoroughly wet the growing medium immediately at transplant and the second, if needed, 6–8 weeks later. Do not make sequential applications of other fungicides in the same group. Do not use a surfactant with this drench application. Do not apply a drench volume greater than 200 mL per plant per application. **REI: 12 hr**
U15	oxathiapiprolin	Orondis	0.175–0.35 L/ha	0	***Phytophthora infestans, Phytophthora capsici*** Foliar application only. Begin applications prior to disease development and continue on a 5–14-day interval. Use the higher end of the rate range and shorter interval when disease pressure is high. Do not make more than 4 applications/yr. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW					
3	myclobutanil	Nova WSP	340 g/ 1,500–3,000 L water/ha	3	Use a maximum of 1 application per crop cycle. Apply as soon as possible after initial infection. **REI: 12 hr**
46	tea tree oil	Timorex Gold *	1–1.5 L/ 400–800 L water/ha	2	***Leveillula taurica*** Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, apply at 7–14-day intervals, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.2 kg in a minimum of 250 L water/ha	1	***Leveillula taurica*** For suppression. Begin applications prior to disease development. Do not apply this product using any type of foggers or misters. Do not apply more than 1 time per crop cycle. Do not use on plants that will be transplanted. **REI: 12 hr**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 475–2,000 L water/ha	1	***Leveillula taurica*** For suppression. Begin applications when conditions become favourable to disease but before infection. If favourable conditions persist, make additional applications on a 7–10-day interval. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. Do not make more than 3 applications per crop cycle. **REI: 24 hr**
M2	sulphur	Agrotek Vaporized Sulphur	0.4–3.2 g/1,000 m^2	NS	***Leveillula taurica*** Use 1 vaporizer per 1,000 m^2. Start using before plants show signs of infection. Use for 1–8 hr per night, 2–7 days per week. Do not apply if temperature is above 24°C and high humidity prevails. Certain species of beneficial insects are sensitive to sulphur. **REI: 2 hr**
		Bartlett Microscopic Wettable Sulphur *	543–760 g/ 1,000 L water/ha	NS	Do not exceed 10 applications per crop cycle. Apply on a minimum of 14-day interval. Do not apply if high temperatures (above 26°C) and high humidity prevail or are expected during the 3 days following application. **REI: 24 hr**
NC	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	***Leveillula taurica*** For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium bicarbonate	MilStop *	5.6 kg/2,000 L water/ha	0	***Leveillula taurica*** Start application at first sign of disease. Uniform and complete coverage of the foliage is essential for the most effective results. Number of applications will depend on disease pressure. Use 7-day intervals between applications. Maximum number of applications per season is 10. Do not apply through any type of irrigation system. **REI: 4 hr**
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	425 g/1,100 L water/ha	NS	***Leveillula taurica*** For suppression. Apply as a foliar spray to leaves and blossoms. Begin applications at transplant and make subsequent sprays at 7-day intervals. Spray to wet, but avoid run-off. **REI: Do not enter treated area until spray is dried.**
P5	*Reynoutria sachalinensis* extract	Regalia Maxx *	0.125%–0.25% v/v (1.25–2.5 mL/L water)	0	***Leveillula taurica*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat as necessary on a 7–10-day interval. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L/ha. **REI: Do not enter treated area until spray is dried.**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
SEPTORIA LEAF SPOT					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	***Septoria lycopersici*** Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	1	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. A maximum of 4 applications can be made per crop cycle. Do not apply more than 2 seeding/seedling applications per crop cycle. Do not apply more than 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
M4	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
NC	garlic powder	Influence WP	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Do not enter treated area until spray is dried.**
	Gliocladium catenulatum strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates:** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g in 300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Streptomyces strain K61	Mycostop WP	See **Remarks.**	NS	***Fusarium* spp.** For suppression. Apply immediately after transplanting. Repeat applications at 3–6-week intervals. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates:** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
21	cyazofamid	Torrent 400 SC	25 mL/100 L water	0	***Phytophthora capsici*** Make the first application of the solution as a soil drench to thoroughly wet the growing medium immediately at transplant and the second, if needed, 6–8 weeks later. Do not make sequential applications of other fungicides in the same group. Do not use a surfactant with this drench application. Do not apply a drench volume greater than 200 mL per plant per application. **REI: 12 hr**
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	1	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. A maximum of 4 applications can be made per crop cycle. Do not apply more than 2 seeding/seedling applications per crop cycle. Do not apply more than 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
M4	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
NC	garlic powder	Influence WP	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Do not enter treated area until spray is dried.**
	Gliocladium catenulatum strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates:** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Streptomyces strain K61	Mycostop WP	See **Remarks.**	NS	***Fusarium* spp., *Phytophthora* spp.** For suppression. Apply immediately after transplanting. Repeat applications at 3–6-week intervals. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates:** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield Granules *	600–750 g/m^3 (loose) planting mix or soil	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. For best results, thoroughly incorporate granules during mix preparation or pot filling, or incorporate into planting beds by raking or tilling. **REI: 4 hr**
		RootShield HC * RootShield WP *	**Drench:** 55–110 g/m^3 using a suspension of 30–45 g/100 L	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

7. Lettuce

Products registered for greenhouse lettuce insect and mite pests are listed in Table 7–1.
Products registered for greenhouse lettuce diseases are listed in Table 7–2.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Maximum number of applications per year is 2. Minimum interval between applications is 10 days. **REI: 12 hr**
		Malathion 25 W	2.75–5.5 kg/ha	leaf: 21 head: 7	For best results apply when the temperature is 20°C or higher. No more than 2 applications per cropping season. **REI: NS**
		Malathion 85 E	735–1,345 mL/ha	7	Maximum number of applications per year is 2. Minimum interval between applications is 10 days. The product is more effective if the temperature is 20°C or more or when temperatures will reach or exceed this minimum. **REI: 12 hr**
		Pro Malathion 50 EC	1.5–2.25 L/ha	leaf: 14 head: 7	Maximum number of applications per year is 2. Minimum interval between applications is 10 days. **REI: 12 hr**
4A	imidacloprid	Intercept 60 WP	**Transplant tray plug drench:** 4.1 g/1,000 seedling plants	28	**Green peach aphid (*Myzus persicae*), lettuce aphid (*Nasonovia ribis-nigri*), melon aphid (*Aphis gossypii*)** For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not apply more than once per crop cycle. Apply product at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m^2 of seedling trays. May harm pollinators and certain beneficial insects. **REI: NS**
23	spirotetramat	Kontos	43–60 mL/100 L water Maximum of 72 g a.i./ha/ application	7	Rate selected for use should depend on infestation level of those pests. Minimum interval between applications is 7 days. Re-apply only when monitoring indicates it is necessary. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed the impact on bees is minimal, and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
ARMYWORMS					
1B	malathion	Malathion 85 E	735–1,345 mL/ha	7	Maximum number of applications per year is 2. Minimum interval between applications is 10 days. **REI: 12 hr**
		Pro Malathion 50 EC	1.5–2.25 L/ha	leaf: 14 head: 7	
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Beet armyworm (*Spodoptera exigu*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
CORN EARWORM (TOMATO FRUITWORM) (*Helicoverpa (=Heliothis) zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
LOOPERS					
3A	lambda-cyhalothrin	Matador 120 EC	83 mL/ha	3	**Cabbage looper (*Trichoplusia ni*)** Apply when insects or damage first appear. For best results, apply against early developmental stages of the pest. Do not use more than 2 applications/yr. Apply in sufficient water to ensure adequate coverage. For best results, apply during the early morning before temperatures rise and during the evening, past the heat of the day. **REI: 24 hr**
		Warrior	83 mL/ha	3	**Cabbage looper (*Trichoplusia ni*)** Apply when insects or damage first appear. For best results, apply against early developmental stages of the pest. Do not use more than 2 applications/yr. Application interval is 7 days. Apply in sufficient water to ensure adequate coverage. For best results, apply during the early morning before temperatures rise and during the evening, past the heat of the day. **REI: 24 hr**
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 500 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	240 mL/1,000 L water		
		Success	120 mL/1,000 L water		

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m^2)	NS	**Cabbage looper (*Trichoplusia ni*)** Apply using a high-volume spray. Apply at 10-day interval when loopers first appear. In general, larvae should be treated when they are newly hatched. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.92 kg/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
		Bioprotec CAF *	1.8 L/1,000 L water		
	Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
18	tebufenozide	Confirm 240F	0.6 L/ha	14	**Cabbage looper (*Trichoplusia ni*)** Apply on early instars. Apply in sufficient water to ensure thorough coverage. Begin applications when first signs of feeding damage appear and repeat applications in 10–14 days if necessary, as determined by population monitoring. Do not exceed 2 applications per crop cycle. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex	50–200 mL/400 L water	0	**Cabbage looper (*Trichoplusia ni*)** Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days if monitoring indicates that it is necessary. **REI: Do not allow worker entry into treated areas until mists have settled.**
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L water **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
17	cyromazine	Citation 75WP	75 g (1 water soluble bag)/ 570 L water	14	***Bradysia* sp.** Apply to the foliage and moist surfaces where the insects breed and feed. Apply sufficient amount of mixture for thorough coverage. Do not exceed 1,010 L spray solution/ha. Allow 7 days between applications. Do not apply more than 4 applications per growing season. Do not apply through any type of irrigation equipment. May adversely affect some species of predatory mites and leafminer parasitoids. **REI: 12 hr**
MEALYBUGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
MEXICAN BEAN BEETLE (*Epilachna varivestris*)					
1B	malathion	Malathion 25 W	2.75–5.5 kg/ha	leaf: 21 head: 7	For best results, apply when the temperature is 20°C or higher. No more than 2 applications. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Maximum number of applications per year is 2. Minimum interval between applications is 10 days. **REI: 12 hr**
		Malathion 25 W	2.75–5.5 kg/ha	leaf: 21 head: 7	**Two-spotted spider mite (*Tetranychus urticae*)** For best results, apply when the temperature is 20°C or higher. No more than 2 applications. **REI: NS**
		Malathion 85 E	735–1,345 mL/ha	7	Maximum number of applications per year is 2. Minimum interval between applications is 10 days. **REI: 12 hr**
NC	*Metarhizium anisopliae* strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray has dried.**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Apply once weekly for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**
PSYLLIDS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**
SLUGS AND SNAILS					
NC	ferric phosphate	Sluggo *	1.2–5 g/m^2	NS	***Deroceras* spp., *Arion* spp., *Helix* spp.** Re-apply as the bait is consumed or at least every 2 weeks if slugs and snails continue to be a problem. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
THRIPS					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Maximum number of applications per year is 2. Minimum interval between applications is 10 days. **REI: 12 hr**
		Malathion 85 E	735–1,345 mL/ha	7	
		Pro Malathion 50 EC	1.5–2.25 L/ha	leaf: 14 head: 7	
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water **Drench:** 108 mL/10 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Do not re-enter treated areas until the spray has dried.**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF	0.46–0.92 kg/1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
		Bioprotec CAF *	0.9–1.8 L/1,000 L water		

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES					
1B	malathion	Malathion 85 E	735–1,345 mL/ha	7	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Maximum number of applications per year is 2. Minimum interval between applications is 10 days. **REI: 12 hr**
		Pro Malathion 50 EC	1.5–2.25 L/ha	leaf: 14 head: 7	Maximum number of applications per year is 2. Minimum interval between applications is 10 days. **REI: 12 hr**
4A	imidacloprid	Intercept 60 WP	**Transplant tray plug drench:** 4.1 g/1,000 seedling plants	28	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not apply more than once per crop cycle. Apply product at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m^2 of seedling trays. May harm pollinators and certain beneficial insects. **REI: NS**
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray has dried.**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 100 parts water	0	Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BLUE MOULD (*Peronospora effusa*)					
40	mandipropamid	Revus	400–600 mL/ha (100–150 g a.i./ha)	7	Applications should begin prior to disease development. Do not make more than 4 applications per season. Apply to transplants only after they have been planted in the field. **REI: 12 hr**
BOTTOM ROT (*Rhizoctonia solani*)					
44	*Bacillus subtilis* var. *amyloliquefaciens* strain FZB24	Taegro 2 WP Taegro WP	190 g/935.4 L water/ha	0	For suppression. Applications should be made to the plant base and soil/growing medium surface to protect the contact between the soil/growing medium and leaf tissue as the lettuce develops. Continue applications at 7-day intervals when conditions are conducive to disease development. Water in solution immediately after application. **REI: 0 hr**
DOWNY MILDEW (*Bremia lactucae*)					
33	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–7 L/ha in a minimum of 100 L water	1	For suppression. Use a maximum of 6 foliar applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
40	mandipropamid	Revus	400–600 mL/ha (100–150 g a.i./ha)	7	Applications should begin prior to disease development. Do not make more than 4 applications per season. Apply to transplants only after they have been planted in the field. **REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	1–2.5 kg/ha	0	For suppression. Begin applications preventively when conditions are favourable for onset of disease. Repeat application every 7–10 days for as long as conditions favour disease development. **REI: Do not re-enter until sprays have dried.**
		Double Nickel LC	5–12.5 L/ha		
	Bacillus subtilis strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin application soon after emergence or transplant and when conditions are conducive to disease development. Repeat as necessary on a 7–10 day interval. **REI: NS**

[1] See Appendix G for FRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*)					
2	iprodione	Rovral WP Rovral WDG	2 kg/2,000 L water/ha	14	Use a high-volume sprayer. Apply a maximum of 4 applications/yr. **REI: 12 hr**
17	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.75 kg a.i./ha)	3	Begin application when conditions favour disease development. Do not make more than 2 applications per crop cycle. **REI: 4 hr**
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant and continue as necessary on a 7–10-day interval. When environmental conditions are conducive to rapid disease development, use in a rotational program with other registered fungicides. Thorough coverage is essential. **REI: NS**
M3	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	NS	Spray seedlings before first transplanting. Repeat once or twice at 10-day intervals. **REI: NS**
NC	*Gliocladium catenulatum* strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr**
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield HC *	10 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet, but avoid run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: NS**
POWDERY MILDEW					
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	***Erysiphe cichoracearum*** For suppression. Begin applications when conditions are conducive to disease development. Repeat as necessary on a 7–10-day interval. Apply sufficient water to ensure complete coverage of entire plant. **REI: NS**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3–1.6 kg in a minimum of 250 L water/ha	0	***Erysiphe cichoracearum*** For suppression. Begin application prior to disease development. Will provide suppression for a period of 10–14 days depending on disease pressure. Do not apply this product using any type of foggers or misters. Do not apply more than 1 time per crop cycle. Do not use on plants that will be transplanted. **REI: 24 hr**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 200–3,000 L water/ha	1	***Erysiphe cichoracearum*** Begin applications prior to or at the onset of disease and repeat applications on a 7–10-day interval if conditions remain favourable for disease development. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. The third application can be made if conditions remain favourable for disease development. Do not make more than 3 applications per crop cycle. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
SCLEROTINIA ROT (SCLEROTINIA DROP, LETTUCE DROP)					
2	iprodione	Rovral WP Rovral WDG	2 kg/2,000 L water/ha	14	Use a high-volume sprayer. Apply a maximum of 4 applications/yr. **REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	**Foliar:** 1–2.5 kg/ha **Low disease pressure:** 0.2–1 kg/ha	0	***Sclerotinia minor, Sclerotinia sclerotiorum*** For suppression. Apply from planting to formation of the head of lettuce. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not re-enter until sprays have dried.**
		Double Nickel LC	**Foliar:** 5–12.5 L/ha **Low disease pressure:** 1–5 L/ha		
	Bacillus subtilis strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	***Sclerotinia minor, Sclerotinia sclerotiorum*** For suppression. Head and leaf drop: Apply as a directed spray with multiple nozzles to each seed line in sufficient water to ensure thorough coverage of lower plant leaves and surrounding soil surface within 7 days of thinning or transplanting. Repeat applications at 10–14-day intervals if conditions for disease development persist. Use high rate and lower applications intervals under conditions of moderate to high disease pressure. **REI: NS**

[1] See Appendix G for FRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
NC	*Gliocladium catenulatum* strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates:** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

[1] See Appendix G for FRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
NC (cont'd)	*Trichoderma harzianum* Rifai strain T-22	Trianum G	See **Remarks.**	NS	***Rhizoctonia solani*** For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. **REI: NS** **Rates:** **Before filling seed trays or containers:** 750 g/m^3 **Subsequent applications at transplanting or reporting:** 375 g/m^3 **Crops on substrate, when transplanting:** 1 g/planting hole
		Trianum P	See **Remarks.**	NS	***Rhizoctonia solani*** For suppression. Sowing application method: For the best results, begin use from propagation onwards, before occurrence of disease. Transplanting high crop density: Use a water volume equivalent to 10% of the substrate volume or 2–5 L/m^2. Low crop density: Use a water volume equivalent to 10% of the substrate volume or 100 L/1,000 plants. **REI: NS** **Rates:** **Sowing:** 1.5 g/m^2 of cultivated area, suspended in 2.5–5 L water **Transplanting high crop density:** 3 g/m^2 of cultivated area (1.5 g/m^2 if plants have been treated previously) **Transplanting low crop density:** 30 g/1,000 plants (15 g/1,000 plants if plants have been treated previously)

[1] See Appendix G for FRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
NC	*Gliocladium catenulatum* strain J1446	Prestop *	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates:** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

[1] See Appendix G for FRAC group definitions.

8. Eggplants

Products registered for greenhouse eggplant insect and mite pests are listed in Table 8–1.
Products registered for greenhouse eggplant diseases are listed in Table 8–2.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable
* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^3	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	16 g/70 L water/ 1,000 mature plants	3	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Irrigate moderately but thoroughly after application, allowing no leaching and runout from container for at least 10 days after application. Do not apply more than once per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
9B	pymetrozine	Endeavor 50 WG	100–200 g in a minimum of 1,000 L water/ha	3	**Green peach aphid (*Myzus persicae*), melon aphid (*Aphis gossypii*)** Do not apply more than 200 g in 1,000 L per application. Do not exceed 2 applications per crop cycle or 3 applications/yr in greenhouses with multiple crop cycles. Apply as a foliar spray. Do not re-apply for at least 7 days. On hard-to-wet plants, add a non-ionic or organosilicone-based surfactant to improve coverage. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
23	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate/single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L/ha (42 mL concentration) to 1,000 L/ha (30 mL concentration). Use the higher concentration for higher pest infestation levels. Interval between applications is at least 7–14 days. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	Deters feeding. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BEET ARMYWORM (*Spodoptera exigu*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
CORN EARWORM (TOMATO FRUITWORM) (*Helicoverpa* (=*Heliothis*) *zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
DUPONCHELIA FOVEALIS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	625 g/1,000 L water	0	Make applications when egg hatch is essentially complete when larvae are small but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. Apply every 7 days as required by monitoring. **REI: NS**
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**
EUROPEAN CORN BORER (*Ostrinia nubilalis*)					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	30 g/1,000 L water	2	Maximum application volume that can be used is 2,000 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
LEAFROLLERS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
LEAFMINERS					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Tomato leafminer (*Tuta absoluta*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
	Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	500–1,000 g/1,000 L water	0	**Lepidopteran leafminers** Apply at egg hatch. Thorough coverage of foliage and stems is necessary. Apply every 7–10 days as required by monitoring. **REI: NS**
18	tebufenozide	Confirm 240F	0.6 L/ha	3	**Lepidopteran leafminers** For suppression. Foliar application only. Use a high-volume sprayer. Apply at first egg hatch. Make a maximum of 4 applications per crop cycle, if monitoring indicates it is required. Applications should be made a minimum of 10 days apart. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
28	chlorantraniliprole	Coragen	200 mL/1,000 L water	1	**Lepidopteran leafminers** Apply at egg hatch. Re-apply if monitoring indicates it is necessary. Thorough coverage is important to obtain optimum control. Do not make more than 3 applications per crop cycle. Do not apply more than once every 7 days. Do not exceed a total of 750 mL product/ha per crop cycle. Apply in a maximum finished spray volume of 1,250 L/ha. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 1,000 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	240 mL/1,000 L water		
		Success	120 mL/1,000 L water		
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF *	75–150 g/250 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use the higher rate range. Repeat applications at an interval to maintain control, usually 3–14 days. Maximum of 4 applications per season. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec CAF *	1.8 L/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
	Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	**Alfalfa looper (*Autographa californica*), Cabbage looper (*Trichoplusia ni*)** For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
28	chlorantraniliprole	Coragen	125 mL/1,000 L water	1	**Cabbage looper (*Trichoplusia ni*)** Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Repeat applications if monitoring indicates it is necessary. Do not make more than 3 applications per crop cycle. Do not apply more than once every 7 days. Do not exceed a total of 750 mL product/ha per crop cycle. The maximum finished spray volume is 2,000 L/ha. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex	50–200 mL/400 L water	0	**Cabbage looper (*Trichoplusia ni*)** Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days if monitoring indicates that it is necessary. **REI: Do not allow worker entry into treated areas until mists have settled.**
MEALYBUGS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
13	chlorfenapyr	Pylon	20–30 mL/100 L	0	**Two-spotted spider mite (*Tetranychus urticae*)** For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to drip. Actual spray volume will vary depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Allow a minimum of 21 days between applications. Do not use product in successive miticide applications. Do not apply more than a maximum of 2 applications per crop (0.69 kg a.i./ha). **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Two-spotted spider mite (*Tetranychus urticae*)** Under high pest population pressure, re-apply in 10–14 days as required by monitoring. Do not apply more than 2 applications per crop cycle. The maximum application volume is 2,000 L water/ha. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
NC	*Metarhizium anisopliae* strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	For suppression. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Apply once weekly for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**
UN	bifenazate	Floramite SC	125 mL (30 g a.i.)/400 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Do not exceed a maximum finished spray volume of 2,000 L/ha per application. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Maximum number of sprays per crop cycle is 2. Make only 1 application of this product before rotating to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. **REI: 12 hr**
PSYLLIDS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap	mix 10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
SLUGS AND SNAILS					
NC	ferric phosphate	Sluggo *	1.2–5 g/m²	NS	***Deroceras* spp., *Arion* spp., *Helix* spp.** Re-apply as the bait is consumed or at least every 2 weeks if slugs and snails continue to be a problem. **REI: NS**
THRIPS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Three applications can be used per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG *	30 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Maximum application volume that can be used is 2,000 L/ha. Apply when western flower thrips first appears. Do not apply by a fogger or mister. Three applications can be used per crop cycle, with a minimum of 7 days between applications. **REI: 12 hr**
		Entrust SC *	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water **Drench:** 108 mL/10 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Do not re-enter treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate otherwise phytotoxicity may result. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
TOBACCO BUDWORM (*Heliothis virescens*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications at an interval sufficient to maintain control, usually 3–14 days, depending on plant growth rate, moth activity and other factors. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec CAF *	0.9–1.8 L/1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L/ha. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Maximum of 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	16 g/70 L water/ 1,000 mature plants	3	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Irrigate moderately but thoroughly after application, allowing no leaching and runout from container for at least 10 days after application. Do not apply more than once per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
7C	pyriproxyfen	Distance	45 mL/100 L water	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype), and sweet potato whitefly (*Bemisia tabaci*)** Do not exceed a maximum finished spray of 2,000 L/ha per application. Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. If necessary, make a second application between 14 and 28 days after the first application. Use longer interval when plants are not growing rapidly. Apply a maximum of 2 applications per cropping cycle. If the cropping cycle is less than 6 months, do not apply more than 2 applications/6 months. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype), and sweet potato whitefly (*Bemisia tabaci*)** Under high pest population pressure, re-apply in 10–14 days as required by monitoring. Do not apply more than 2 applications per crop cycle. The maximum application volume is 2,000 L water/ha. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate/ single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L/ha (42 mL concentration) to 1,000 L/ha (30 mL concentration). Use the higher concentration for higher pest infestation levels. Interval between applications is at least 7–14 days. Maximum product allowed per crop cycle is 900 mL/ha (216 g a.i./ha). Maximum number of applications per cropping cycle is 3. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Metarhizium anisopliae strain F52	Met52 EC	Foliar: 0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	Deters feeding. Apply when pests appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Neudosan Commercial *	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. **REI: NS**
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 100 parts water	0	Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BACTERIAL CANKER (*Clavibacter michiganensis* subsp. *michiganensis*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not make more than 3 applications per season. A minimum interval of 7 days between applications is required. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL SPECK (BACTERIAL BLIGHT) (*Pseudomonas syringae* pv. *tomato*)					
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat as necessary on a 7–10-day interval. **REI: NS**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL SPOT (BACTERIAL LEAF SPOT) (*Xanthomonas campestris* pv. *vesicatoria*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not make more than 3 applications per season. A minimum interval of 7 days between applications is required. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
EARLY BLIGHT (*Alternaria solani*)					
7	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	For suppression. Begin applications prior to disease development. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55 Double Nickel LC	0.5–2 kg/ha 2.5–10 L/ha	0	Apply from flowering to fruiting. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not re-enter until sprays have dried.**
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*)					
7	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	Begin applications prior to disease development. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	**Foliar:** 1.25–3.6 kg/ha **Low disease pressure:** 0.9–1 kg/ha	0	For suppression. Use from flowering to fruit maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not re-enter until sprays have dried.**
		Double Nickel LC	**Foliar:** 6.25–18 L/ha **Low disease pressure:** 4.5–5 L/ha		
	Bacillus subtilis strain QST 713	Cease	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat as necessary on a 7–10-day interval. **REI: NS**
		Rhapsody ASO			
NC	*Trichoderma harzianum* Rifai strain KRL-AG2	RootShield HC *	3.75–7.5 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet, but avoid run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**
LATE BLIGHT					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	***Phytophthora infestans*** Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
POWDERY MILDEW					
M2	sulphur	Agrotek Vaporized Sulphur	0.4–3.2 g/1,000 m^3	NS	***Leveillula taurica*** Use 1 vaporizer per 1,000 m^3. Start using before plants show signs of infection. Use for 1–8 hr per night, 2–7 days/week. Do not apply if temperature is above 24°C and high humidity prevails. Certain species of beneficial insects are sensitive to sulphur. **REI: 2 hr**
NC	mineral oil	Purespray Green Spray Oil 13E *	10 L/ 1,000 L water (1% solution)/ ha	NS	***Leveillula taurica*** For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Apply at 7–14-day intervals. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
SEPTORIA LEAF SPOT					
M1	copper octanoate	Cueva Commercial *	0.5%–2% solution applied at 470–940 L/ha	1	***Septoria lycopersici*** Re-apply using 5–10-day intervals. Do not exceed 15 applications/yr. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. A maximum of 4 applications can be made per crop cycle. Do not apply more than 2 seeding/seedling applications per crop cycle. Do not apply more than 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
M4	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			
NC	*Streptomyces lydicus* strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g in 300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. A maximum of 4 applications can be made per crop cycle. Do not apply more than 2 seeding/seedling applications per crop cycle. Do not apply more than 2 after transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
M4	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF Supra Captan 80 WP	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
NC	*Streptomyces lydicus* strain WYEC 108	Actinovate SP *	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat every 7–14 days. **REI: Do not enter treated area until spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g in 300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield WP *	**Drench:** 55–110 g/m^3 using a suspension of 30–45 g/100 L	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: NS**

[1] See Appendix G for FRAC group definitions.

9. Strawberries

Products registered for greenhouse strawberry insect and mite pests are listed in Table 9–1.
Products registered for greenhouse strawberry diseases are listed in Table 9–2.

Table 9–1. Products registered for greenhouse strawberry insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REII = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
29 (formerly 9C)	flonicamid	Beleaf 50 SG	0.3 g/L water	0	Apply when pests first appear and before populations reach high levels. Do not apply more than 1 application per crop cycle. Thorough spray coverage of plant foliage is essential for optimum control. Use a maximum spray volume of 650 L. Do not apply using fogging or ultra low-volume equipment. Do not apply using handheld mistblowers or handheld airblast equipment. This product will stop pest feeding rapidly but it may take several days to see a reduction in pest numbers. **REI: 12 hr**
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. **REI: 4 hr**
	potassium salts of fatty acids	Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
EARWIGS					
NC	potassium salts of fatty acids	Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**
LYGUS BUGS					
29 (formerly 9C)	flonicamid	Beleaf 50 SG	0.3 g/L water	0	**Tarnished plant bug (*Lygus lineolaris*)** Apply when pests first appear and before populations reach high levels. Do not apply more than 1 application per crop cycle. Thorough spray coverage of plant foliage is essential for optimum control. Use a maximum spray volume of 650 L. Do not apply using fogging or ultra low-volume equipment. Do not apply using handheld mistblowers or handheld airblast equipment. This product will stop pest feeding rapidly but it may take several days to see a reduction in pest numbers. **REI: 12 hr**
MEALYBUGS					
NC	potassium salts of fatty acids	Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 9–1. Products registered for greenhouse strawberry insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
NC	*Metarhizium anisopliae* Strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray is dried.**
	potassium salts of fatty acids	Safer's Insecticidal Soap	10 mL/500 mL water	NS	**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**
PSYLLIDS					
NC	potassium salts of fatty acids	Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply when pests occur and repeat as needed. **REI: NS**
SLUGS & SNAILS					
NC	ferric phosphate	Sluggo *	1.2–5 g/m^2	NS	***Deroceras* spp., *Arion* spp., *Helix* spp.** Re-apply as the bait is consumed or at least every 2 weeks, if slugs and snails continue to be a problem. **REI: NS**
THRIPS					
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray is dried.**
WHITEFLIES					
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Spray to wet, but avoid run-off. Apply at 5–10-day intervals. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. May re-apply in 5–10 days. Spray to wet all foliage, but avoid run-off. Do not apply through a thermal pulse fogger. **REI: Do not re-enter treated areas until the spray is dried.**
	potassium salts of fatty acids	Safer's Insecticidal Soap	10 mL/500 mL water	NS	Insects must be sprayed directly to achieve proper control. Apply weekly for 2–3 weeks and thereafter repeat as required. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 9–2. Products registered for greenhouse strawberry diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*)					
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	**Foliar:** 1–2.5 kg/ha **Low disease pressure:** 0.6–1 kg/ha	0	For suppression. Apply at or just before flowering until fruit maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not enter treated area until spray is dried.**
		Double Nickel LC	**Foliar:** 5–12.5 L/ha **Low disease pressure:** 3–5 L/ha		
NC	*Streptomyces lydicus* strain WYEC 108	Actinovate SP *	425 g/1,100 L water/ha	NS	For suppression. Make the first application when conditions are conducive to disease development. Apply to foliage and blossoms. Repeat application every 7–14 days. Use the shorter application interval under high disease pressure. **REI: Do not enter treated area until spray is dried.**
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield HC *	10 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet, but avoid run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**
P5	*Reynoutria sachalinensis* extract	Regalia Maxx *	0.25% v/v in 500–1,000 L water/ha	0	For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat as necessary on a 7–10-day interval. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L/ha. **REI: Do not enter treated area until spray is dried.**

[1] See Appendix G for FRAC group definitions.

Table 9–2. Products registered for greenhouse strawberry diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW					
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55	**Foliar:** 1–2.5 kg/ha **Low disease pressure:** 0.5–1 kg/ha	0	***Sphaerotheca macularis*** For suppression. Apply at or just before flowering until fruit maturity. Repeat application every 7–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not enter treated area until spray is dried.**
		Double Nickel LC	**Foliar:** 5–12.5 L/ha **Low disease pressure:** 2.5–5 L/ha		
M2	sulphur	Agrotek Vaporized Sulphur	0.4–3.2 g/1,000 m^2	NS	***Sphaerotheca macularis*** Use 1 vaporizer per 1,000 m^2. Start using before plants show signs of infection. Use for 1–8 hr per night, 2–7 days per week. Do not apply if temperature is above 24°C and high humidity prevails. Certain species of beneficial insects are sensitive to sulphur. **REI: 2 hr**
NC	*Streptomyces lydicus* strain WYEC 108	Actinovate SP *	425 g/1,100 L water/ha	NS	***Sphaerotheca macularis*** For suppression. Make the first application when conditions are conducive to disease development. Apply to foliage and blossoms. Repeat application every 7–14 days. Use the shorter application interval under high disease pressure. **REI: Do not enter treated area until spray is dried.**
P5	*Reynoutria sachalinensis* extract	Regalia Maxx *	0.125%–0.25% v/v in 500–1,000 L water/ha	0	***Sphaerotheca macularis*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat as necessary on a 7–10-day interval. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L/ha. **REI: Do not enter treated area until spray is dried.**

[1] See Appendix G for FRAC group definitions.

Appendices

Appendix A. Ontario Ministry of Agriculture, Food and Rural Affairs Greenhouse Vegetable Staff

Cara McCreary
Greenhouse Vegetable IPM Specialist
Harrow Research and Development Centre
2585 County Road 20
Harrow, ON N0R 1G0

Tel: 519-738-1258
Fax: 519-738-4564
E-mail: cara.mccreary@ontario.ca

Shalin Khosla
Greenhouse Vegetable Specialist
Harrow Research and Development Centre
2585 County Road 20
Harrow, ON N0R 1G0

Tel: 519-738-1257
Fax: 519-738-4564
E-mail: shalin.khosla@ontario.ca

Agricultural Information Contact Centre
Provides province-wide, toll-free technical and business information to commercial farms, agri-businesses and rural businesses.

1 Stone Rd. W.
Guelph, ON N1G 4Y2

Toll-free 1-877-424-1300
Fax 519-826-3442
E-mail ag.info.omafra@ontario.ca

A complete list of Ontario Ministry of Agriculture, Food and Rural Affairs staff is available on the OMAFRA website at ontario.ca/crops.

Appendix B.
Diagnostic Service

Samples for disease diagnosis, insect or weed identification, nematode counts and verticillium testing can be sent to:

Pest Diagnostic Clinic
Laboratory Services Division
University of Guelph
95 Stone Rd. W.
Guelph, ON N1H 8J7

Tel 519-767-6299
Fax 519-767-6240
E-mail aflinfo@uoguelph.ca

www.guelphlabservices.com

Payment must accompany samples at the time of submission. Submission forms are available at: www.guelphlabservices.com/AFL/submit_samples.aspx.

How to Sample for Nematodes

Soil

When to sample

Soil and root samples can be taken at any time of the year that the soil is not frozen. In Ontario, nematode soil population levels are generally at their highest in May and June, and again in September and October.

How to sample soil

Use a soil sampling tube, trowel or narrow-bladed shovel to take samples. Sample soil to a depth of 20–25 cm. If the soil is bare, remove the top 2 cm prior to sampling. A sample should consist of 10 or more subsamples combined. Mix well in a clean pail or plastic bag. Then take a sample of 0.5–1 L from this. No one sample should represent more than 2.5 ha.

Sampling pattern

If living crop plants are present in the sample area, take samples within the row and from the area of the feeder root zone (with trees, this is the drip line).

Number of subsamples

Based on the total area sampled:

500 m^2	10 subsamples
500 m^2–0.5 ha	25 subsamples
0.5 ha–2.5 ha	50 subsamples

Roots

For small plants, sample the entire root system plus adhering soil. For large plants, 10–20 g, dig fresh weight from the feeder root zone and submit.

Problem areas

Take soil and root samples from the margins of the problem area where the plants are still living. If possible, also take samples from healthy areas in the same field.

Sample Handling

Soil samples

Place soil samples in plastic bags as soon as possible after collecting.

Root samples

Place in plastic bags and cover with moist soil from the sample area.

Storage

Store samples at 5°C–10°C and do not expose them to direct sunlight or extreme heat or cold (freezing). Only living nematodes can be counted. Accurate counts depend on proper handling of samples.

Submitting Plant for Disease Diagnosis or Identification

Sample submission forms

Forms can be obtained from the Laboratory Services website at www.guelphlabservices.com or your local Ontario Ministry of Agriculture, Food and Rural Affairs office. Carefully fill in all of the categories on the form. In the space provided, draw the most obvious symptom and the pattern of the disease in the field.

It is important to include the cropping history of the area for the past 3 years and this year's pesticide use records.

Choose a complete, representative sample showing early symptoms. Submit as much of the plant as is practical, including the root system, or several plants showing a range of symptoms. If symptoms are general, collect the sample from an area where they are of intermediate severity. Completely dead material is usually inadequate for diagnosis.

With plant specimens submitted for identification, include at least a 20–25-cm sample of the top portion of the stem with lateral buds, leaves, flowers or fruits in identifiable condition. Wrap plants in newspaper and put in a plastic bag. Tie the root system off in a separate plastic bag to prevent it from drying out and to prevent the soil from contaminating the leaves. Do **not** add moisture, as this encourages decay in transit. Cushion specimens and pack them in a sturdy box to avoid damage during shipping. Avoid leaving specimens to bake or freeze in a vehicle or in a location where they could deteriorate.

Delivery

Deliver to the Pest Diagnostic Clinic as soon as possible by first class mail or courier at the beginning of the week.

Submitting Insect Specimens for Identification

Collecting samples

Place dead, hard-bodied insects in vials or boxes and cushion with tissues or cotton. Place soft-bodied insects and caterpillars in vials containing alcohol. Do not use water, as this results in rot. Do not tape insects to paper or send them loose in an envelope.

Place live insects in a container with enough plants for them to feed on during transit. Be sure to write "live" on the outside of the container.

Appendix C.
Other Contacts

AGRICULTURE & AGRI-FOOD CANADA RESEARCH CENTRES

www.agr.gc.ca/index_e.php

Harrow Research and Development Centre
2585 County Road 20
Harrow, ON N0R 1G0
Tel 519-738-2251

Southern Crop Protection and Food Research Centre
1391 Sandford St.
London, ON N5V 4T3
Tel 519-457-1470

Vineland Research Farm
4902 Victoria Ave. N.
Vineland, ON L0R 2E0
Tel 905-562-4113

VINELAND RESEARCH AND INNOVATION CENTRE

www.vinelandontario.ca

4890 Victoria Ave. N.
Vineland Station, ON L0R 2E0
Tel 905-562-0320
Fax 905-562-0084

CANADIAN FOOD INSPECTION AGENCY REGIONAL OFFICES (PLANT PROTECTION)

www.inspection.gc.ca/english/toce.shtml

Belleville
345 College St. E.
Belleville, ON K8N 5S7
Tel 613-969-3333

Brantford
625 Park Rd. N., Ste. 6
Brantford, ON N3T 5P9
Tel 519-753-3478

Guelph
174 Stone Rd. W.
Guelph, ON N1G 4T1
Tel 519-837-9400

Hamilton
709 Main St. W., Ste. 101
Hamilton, ON L8S 1A2
Tel 905-572-2201

London
19-100 Commissioners Rd. E.
London, ON N5Z 4R3
Tel 519-691-1300

Ottawa District
38 Auriga Dr., Unit 8
Ottawa, ON K2E 8A5
Tel 613-274-7374, ext. 221

Toronto
1124 Finch Ave. W., Unit 2
Downsview, ON M3J 2E2
Tel 416-665-5055

UNIVERSITY OF GUELPH

Main Campus
Guelph, ON N1G 2W1
Tel 519-824-4120
www.uoguelph.ca

Ridgetown Campus
Ridgetown, ON N0P 2C0
Tel 519-674-1500
www.ridgetownc.on.ca

Department of Plant Agriculture

www.plant.uoguelph.ca

Department of Plant Agriculture, Guelph
50 Stone Rd. E.
Guelph, ON N1G 2W1
Tel 519-824-4120, ext. 56083
Fax 519-763-8933

Department of Plant Agriculture, Simcoe
1283 Blueline Rd., Box 587
Simcoe, ON N3Y 4N5
Tel 519-426-7127
Fax 519-426-1225

Department of Plant Agriculture, Vineland
Box 7000, 4890 Victoria Ave. N.
Vineland Station, ON L0R 2E0
Tel 905-562-4141
Fax 905-562-3413

Lab Services Division

www.uoguelph.ca/labserv

P.O. Box 3650, 95 Stone Rd. W.
Guelph, ON N1H 8J7
Tel 519-767-6299
Fax 519-767-6240

Trace Organic and Pesticide Contaminants
Tel 519-767-6485
Fax 519-767-6240

Pest Diagnostic Clinic
Tel 519-767-6256

Appendix D. Pesticide Groups Based on Sites of Action — Insecticides and Miticides

The classification scheme listed below is adapted from information developed by the Insecticide Resistance Action Committee Mode of Action Working Group. Products with the same group number have a similar mode of action. For details on this classification system, see www.irac-online.org/eClassification/.

Group #	Primary Site of Action	Group Name	Product Name(s)
1B	Acetylcholinesterase inhibitor Nerve action	organophosphate	DDVP 20% EC, Dibrom, Malathion 25 W, Malathion 85 E
2A	GABA-gated chloride channel agonists Nerve action	chlorinated cyclodienes	Thionex 50 W, Thionex EC
3	Sodium channel modulators Nerve action	pyrethroids, pyrethrins	Ambush 50 EC, Matador 120 EC, Pounce 384 EC
4	Nicotinic acetylcholine receptor agonists Nerve action	neonicotinoids	Actara 25 WG, Intercept 60 WP, Tristar 70 WSP
5	Nicotinic acetylcholine receptor (allosteric) Nerve action	spinosyns	Entrust 80 W, Success
6	Chloride channel activators Nerve and muscle action	avermectins	Avid 1.9% EC
7C	Juvenile hormone mimics Growth regulation	pyriproxyfen	Distance
9B	Selective homopteran feeding blockers	pymetrozine	Endeavor 50 WG
9C	Nerve action Modulators of chordotonal organs	flonicamid	Beleaf 50 SG
11	Microbial disruptors of insect midgut membranes	*Bacillus thuringiensis*	Bioprotec 3P, Bioprotec CAF, DiPel 2X DF, DiPel WP, Foray 48BA, VectoBac 600 L
12B	Inhibitors of mitochondrial ATP synthase Energy metabolism	organotin miticides	Vendex 50 WP
13	Energy metabolism — Uncouplers of oxidative phosphorylation via disruption of the proton gradient	chlorfenapyr	Pylon
17	Moulting disruptor Growth regulation	cyromazine	Citation 75 WP
18	Ecdysone receptor agonists Growth regulation	diacylhydrazine	Confirm 240 F
20B	Energy metabolism Mitochondrial complex III electron transport inhibitors	acequinocyl	Shuttle 15 SC
21A	Mitochondrial complex I electron transport inhibitors (METI) Energy metabolism	METI insecticides and acaricides	DynoMite 75 WP
23	Inhibitors of acetyl CoA carboxylase Lipid synthesis, growth regulation	tetronic and tetramic acid derivatives	Forbid 240 SC, Kontos
28	Ryanodine receptor modulator Nerve and muscle action	chlorantraniliprole	Coragen
Un	Compounds of unknown or uncertain mode of action[1]	bifenazate	Floramite SC

[1] A compound with an unknown mode of action or where consensus does not exist on mode of action or an unknown mode of toxicity will be held in category "un" until evidence becomes available to enable that compound to be assigned to a more appropriate mode of action class.

Appendix E. Pesticide Groups Based on Sites of Action — Fungicides

This classification scheme is adapted from information developed by the Fungicide Resistance Action Committee to distinguish fungicide groups according to their cross-resistance behaviour. For further details on this classification system, see www.frac.info/docs/default-source/publications/frac-code-list/frac-code-list-2016.pdf?sfvrsn=2.

M = multi-site inhibitor U = unknown mode of action and unknown resistance risk NC = not classified

Group #	Primary Site of Action	Group Name	Product Name(s)	Risk of Developing Resistance
2	Cell division, DNA & RNA synthesis & metabolism	dicarboximides	Rovral 50 WP	medium to high
3	C14-demethylase in sterol biosynthesis	DMI (demethylationinhibitor) fungicides	Nova 40 W	medium
4	RNA synthesis	PA (phenylamide) fungicides	Ridomil Gold 480 EC or Ridomil Gold 480 SL	high
7	Fungal respiration — complex II: succinate dehydrogenase	SDHI (succinate dehydrogenase inhibitors)	Fontelis, Pristine WG (boscalid = 7 + pyraclostrobin = 11)	medium to high
9	Methionine biosynthesis (proposed)	Anilino-pyrimidines	Scala SC, Switch (cyprodinil = 9 + fludioxinil = 12)	medium
11	Fungal respiration — complex III: cytochrome bc1	QoI (quinone outside inhibitor) fungicides	Pristine WG (boscalid = 7 + pyraclostrobin = 11)	high
12	MAP/histidine-kinase in osmotic signal transduction	phenylpyrrole	Switch (cyprodinil = 9 + fludioxinil = 12)	low to medium
14	Lipid peroxidation (proposed)	aromatic hydrocarbons	Botran 75 W	low to medium
17	3-keto reductase, C4 demethylation	hydroxyanilides	Decree 50 WDG	low to medium
24	Protein synthesis	hexopyranosyl antibiotic	Kasumin 2L	resistance known in fungal and bacterial (*P. glumae*) pathogens. medium risk resistance management required
28	Cell membrane permeability, fatty acids (proposed)	carbamates	Previcur N	low to medium
40	Phospholipid biosynthesis and cell wall deposition (proposed)	carboxylic acid amides	Revus	low to medium
44	Microbial disrupters of pathogen cell membranes	microbial (*Bacillus* sp.)	Cease, Rhapsody, Taegro	low
M1	Multi-site contact activity	inorganic	Copper Spray Fungicide, Kocide 3000	low
M2	Multi-site contact activity	inorganic	Kumulus DF, Microthiol Disperss, Sulphur (Bartlett's Microscopic Sulphur 92%), Agrotek Ascend Vaporized Sulphur	low
M3	Multi-site contact activity	dithiocarbamates	Manzate Pro-Stick	low
M4	Multi-site contact activity	pthalilimides	Maestro 80 DF, Supra Captan 80 WDG	low
NC	Unknown	diverse	Cyclone, Influence, MilStop	unknown
P5	Host plant defence induction	plant extract	Regalia Maxx	unknown

Appendix F. IRAC (Insecticide Resistance Action Committee) Chemical Sub-groups

To reduce the risk of a pest developing resistance, rotate between chemical groups and/or families within the same crop cycle or year.

1B	organophosphates
3A	pyrethroids, pyrethrins
4A	neonicotinoids
5	spinosyns
6	avermectins, mibemycins
7C	pyriproxyfen
9B	pyridine azomethine derivatives
10B	etoxazole
11A	*Bacillus thuringiensis* and the insecticidal proteins they produce
12B	organotin miticides
13	pyrroles, dinitrophenols, sulfuramid
18	diacylhydrazines
20B	acequinocyl
21A	METI acaricides and insecticides
23	tetronic and tetramic acid derivatives
28	diamides
29	flonicamid, pyrethrins
NC	not classified
UN	unknown mode of action (MOA)

Appendix G. FRAC (Fungicide Resistance Action Committee) Chemical Groups

To reduce the risk of a pathogen developing resistance, rotate between chemical groups and/or families within the same crop cycle or year.

2	dicarboximides
3	triazoles
7	pyrazole, 4-carboxamides
9	anilino-pyrimidines
17	hydroxyanilides
24	hexopyranosylantibiotic
28	carbamates
33	not stated
40	mandelic acid amides
44	*Bacillus* sp. and the fungicidal lipopeptides produced
46	terpene hydrocarbons and terpene alcohols
7+11	pyrazole-4-carboxamides and methoxy-carbamates
9 + 12	anilino-pyrimidines and phenylpyrroles
M1	inorganic
M2	inorganic
M3	dithio-carbamates and relatives
M4	phthalimides
NC	not classified
P5	complex mixture, ethanol extract

Appendix H.

Ontario Ministry of the Environment and Climate Change Regional Contact Information

REGION County	Address	Telephone/Fax
Central Region Toronto, Halton, Peel, York, Durham, Muskoka, Simcoe	5775 Yonge St., 8th Floor Toronto, ON M2M 4J1	Tel 416-326-6700 Toll-free 1-800-810-8048 Fax 416-325-6345
West-Central Region Haldimand, Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	Ontario Government Building 119 King St. W., 12th Floor Hamilton, ON L8P 4Y7	Tel 905-521-7640 Toll-free 1-800-668-4557 Fax 905-521-7820
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/ Dundas & Glengarry, Haliburton, Peterborough, Kawartha Lakes, Northumberland, Renfrew, Ottawa, Lanark, District of Nipissing (Township of South Algonquin)	1259 Gardiners Rd., Unit 3 P.O. Box 22032 Kingston, ON K7M 8S5	Tel 613-549-4000 Toll-free 1-800-267-0974 Fax 613-548-6908
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth	733 Exeter Rd. London, ON N6E 1L3	Tel 519-873-5000 Toll-free 1-800-265-7672 Fax 519-873-5020
Northern Region (EAST) Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma (East), Timiskaming, Sault Ste. Marie	199 Larch St., Ste. 1201 Sudbury, ON P3E 5P9	Tel 705-564-3237 Toll-free 1-800-890-8516 Fax 705-564-4180
Northern Region (West) Algoma (West), Cochrane, Kenora, Rainy River, Timmins, Thunder Bay	435 James St. S., Ste. 331 Thunder Bay, ON P7E 6S7	Tel 807-475-1205 Toll-free 1-800-875-7772 Fax 807-475-1745
Standards Development Branch	Pesticides Section 40 St. Clair Ave. W., 7th Floor Toronto, ON M4V 1M2	Tel 416-327-5519 Fax 416-327-2936
Approvals Branch	Pesticides Licensing 2 St. Clair Ave. W., 12A Floor Toronto, ON M4V 1L5	Tel 416-314-8001 Toll-free 1-800-461-6290 Fax 416-314-8452

Appendix I.
The Metric System

Metric units

Linear measures (length)

10 millimetres (mm) = 1 centimetre (cm)
100 centimetres (cm) = 1 metre (m)
1,000 metres = 1 kilometre (km)

Square measures (area)

100 m × 100 m = 10,000 m^2 = 1 hectare (ha)
100 ha = 1 square kilometre (km^2)

Cubic measures (volume)

Dry measure

1,000 cubic millimetres (mm^3) = 1 cubic centimetre (cm^3)
1,000,000 cm^3 = 1 cubic metre (m^3)

Liquid measure

1,000 millilitres (mL) = 1 litre (L)
100 L = 1 hectolitre (hL)

Weight-volume equivalents (for water)

(1.00 kg) 1,000 grams = 1 litre (1.00 L)
(0.50 kg) 500 g = 500 mL (0.50 L)
(0.10 kg) 100 g = 100 mL (0.10 L)
(0.01 kg) 10 g = 10 mL (0.01 L)
(0.001 kg) 1 g = 1 mL (0.001 L)

Weight measures

1,000 milligrams (mg) = 1 gram (g)
1,000 g = 1 kilogram (kg)
1,000 kg = 1 tonne (t)
1 mg/kg = 1 part per million (ppm)

Dry–liquid equivalents

1 cm^3 = 1 mL
1 m^3 = 1,000 L

Dry weight conversions (approximate)

Metric grams or kilograms/hectare		Imperial ounces or pounds/acre
100 g/ha	=	1½ oz/acre
200 g/ha	=	3 oz/acre
300 g/ha	=	4¼ oz/acre
500 g/ha	=	7 oz/acre
700 g/ha	=	10 oz/acre
1.10 kg/ha	=	1 lb/acre
1.50 kg/ha	=	1¼ lb/acre
2.00 kg/ha	=	1¾ lb/acre
2.50 kg/ha	=	2¼ lb/acre
3.25 kg/ha	=	3 lb/acre
4.00 kg/ha	=	3½ lb/acre
5.00 kg/ha	=	4½ lb/acre
6.00 kg/ha	=	5¼ lb/acre
7.50 kg/ha	=	6¾ lb/acre
9.00 kg/ha	=	8 lb/acre
11.00 kg/ha	=	10 lb/acre
13.00 kg/ha	=	11½ lb/acre
15.00 kg/ha	=	13½ lb/acre

Liquid equivalents (approximate)

50 L/ha	=	4.45 gal/acre	(5.35 US gal/acre)
100 L/ha	=	8.90 gal/acre	(10.70 US gal/acre)
150 L/ha	=	13.35 gal/acre	(16.05 US gal/acre)
200 L/ha	=	17.80 gal/acre	(21.40 US gal/acre)
250 L/ha	=	22.25 gal/acre	(26.75 US gal/acre)
300 L/ha	=	26.70 gal/acre	(32.10 US gal/acre)

Application rate conversions

Metric to Imperial or U.S. (approximate)

litres per hectare × 0.09 = Imp. gallons per acre
litres per hectare × 0.11 = U.S. gallons per acre
litres per hectare × 0.36 = Imp. quarts per acre
litres per hectare × 0.43 = U.S. quarts per acre
litres per hectare × 0.71 = Imp. pints per acre
litres per hectare × 0.86 = U.S. pints per acre
millilitres per hectare × 0.014 = U.S. fluid ounces per acre
grams per hectare × 0.014 = ounces per acre
kilograms per hectare × 0.89 = pounds per acre
tonnes per hectare × 0.45 = tons per acre

Imperial or U.S. to metric (approximate)

Imp. gallons per acre × 11.23 = litres per hectare (L/ha)
U.S. gallons per acre × 9.35 = litres per hectare (L/ha)
Imp. quarts per acre × 2.8 = litres per hectare (L/ha)
U.S. quarts per acre × 2.34 = litres per hectare (L/ha)
Imp. pints per acre × 1.4 = litres per hectare (L/ha)
U.S. pints per acre × 1.17 = litres per hectare (L/ha)
Imp. fluid ounces per acre × 70 = millilitres per hectare (mL/ha)
U.S. fluid ounces per acre × 73 = millilitres per hectare (mL/ha)
tons per acre × 2.24 = tonnes per hectare (t/ha)
pounds per acre × 1.12 = kilograms per hectare (kg/ha)
pounds per acre × 0.45 = kilograms per acre (kg/acre)
ounces per acre × 70 = grams per hectare (g/ha)

Metric conversions

5 mL = 1 tsp
15 mL = 1 tbsp
28.5 mL = 1 imp. fl. oz.

Conversion tables – metric to imperial (approximate)

Length	
1 millimetre (mm)	= 0.04 inches
1 centimetre (cm)	= 0.40 inches
1 metre (m)	= 39.40 inches
1 metre (m)	= 3.28 feet
1 metre (m)	= 1.09 yards
1 kilometre (km)	= 0.62 miles
Area	
1 square centimetre (cm^2)	= 0.16 square inches
1 square metre (m^2)	= 10.77 square feet
1 square metre (m^2)	= 1.20 square yards
1 square kilometre (km^2)	= 0.39 square miles
1 hectare (ha)	= 107,636 square feet
1 hectare (ha)	= 2.5 acres
Volume (dry)	
1 cubic centimetre (cm^3)	= 0.061 cubic inches
1 cubic metre (m^3)	= 1.31 cubic yards
1 cubic metre (m^3)	= 35.31 cubic feet
1,000 cubic metres (m^3)	= 0.81 acre-feet
1 hectolitre (hL)	= 2.8 bushels
Volume (liquid)	
1 millilitre (mL)	= 0.035 fluid ounces (Imp.)
1 litre (L)	= 1.76 pints (Imp.)
1 litre (L)	= 0.88 quarts (Imp.)
1 litre (L)	= 0.22 gallons (Imp.)
1 litre (L)	= 0.26 gallons (U.S.)
Weight	
1 gram (g)	= 0.035 ounces
1 kilogram (kg)	= 2.21 pounds
1 tonne (t)	= 1.10 short tons
1 tonne (t)	= 2,205 pounds
Pressure	
1 kilopascal (kPa)	= 0.15 pounds/$in.^2$
Speed	
1 metre per second	= 3.28 feet per second
1 metre per second	= 2.24 miles per hour
1 kilometre per hour	= 0.62 miles per hour
Temperature	
°F =	(°C × ⅘) + 32

Conversion tables – imperial to metric (approximate)

Length	
1 inch	= 2.54 cm
1 foot	= 0.30 m
1 yard	= 0.91 m
1 mile	= 1.61 km
Area	
1 square foot	= 0.09 m^2
1 square yard	= 0.84 m^2
1 acre	= 0.40 ha
Volume (dry)	
1 cubic yard	= 0.76 m^3
1 bushel	= 36.37 L
Volume (liquid)	
1 fluid ounce (Imp.)	= 28.41 mL
1 pint (Imp.)	= 0.57 L
1 gallon (Imp.)	= 4.55 L
1 gallon (U.S.)	= 3.79 L
Weight	
1 ounce	= 28.35 g
1 pound	= 453.6 g
1 ton	= 0.91 tonne
Pressure	
1 pound per square inch	= 6.90 kPa
Temperature	
°C =	(°F – 32) × ⅝

Handy Approximate Metric Conversion Factor
litres per hectare × 0.4 = litres per acre
kilograms per hectare × 0.4 = kilograms per acre

Abbreviations

%	= per cent
a.i.	= active ingredient
AP	= agricultural powder
cm	= centimetre
cm^2	= square centimetre
CS	= capsule suspension
DF	= dry flowable
DG	= dispersible granular
DP	= dispersible powder
E	= emulsifiable
EC	= electrical conductivity
e.g.	= for example
F	= flowable
g	= gram
Gr	= granules, granular
ha	= hectare
kg	= kilogram
km/h	= kilometres per hour
kPa	= kilopascal
L	= litre
m	= metre
m^2	= square metre
mL	= millilitre
mm	= millimetre
m/s	= metres per second
SC	= sprayable concentrate
SP	= soluble powder
t	= tonne
W	= wettable (powder)
WDG	= water dispersible granular
WG	= wettable granule
WP	= wettable powder

Calculating Parts per Million (ppm)
1 ppm = 1 g active ingredient per 1,000 L water

Emergency and First-Aid Procedures for Pesticide Poisoning

For pesticide poisonings and pesticide injuries, call the Poison Information Centre:
Toronto 1-800-268-9017

PREVENT ACCIDENTS

- **Read the label.** Follow all the precautions the label recommends. Read the First Aid section of the label BEFORE you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Material Safety Data Sheets (MSDS) for the pesticides you use.** Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.

If someone has been working with pesticides and you see any possible symptoms of pesticide poisoning or injury, take emergency action immediately.

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IF AN ACCIDENT OR POISONING HAPPENS

- Protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the four basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.
- Call an ambulance or the Poison Information Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, MSDS sheet or container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

FIRST AID

If a pesticide comes in contact with skin:

- Remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water
- Dry skin well and cover with clean clothing or other clean material.

If pesticide comes in contact with eyes:

- Hold eyelids open; wash the eyes with clean running water for 15 minutes or more.

If pesticide was inhaled:

- Move the victim to fresh air and loosen tight clothing
- Give artificial respiration if the victim is not breathing

Do not breathe in the exhaled air from the victim — you could also be poisoned.

If a pesticide was swallowed:

- Call the Poison Information Centre IMMEDIATELY.

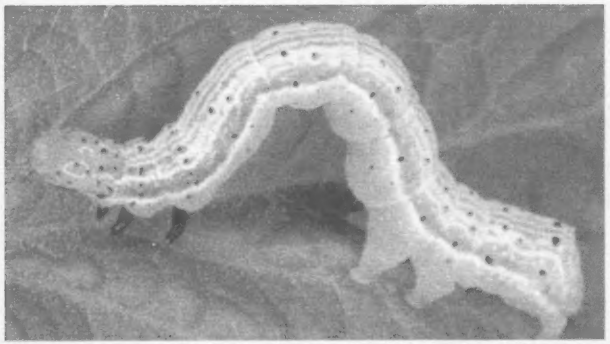
Emergency numbers are listed at the front of each Bell telephone directory.

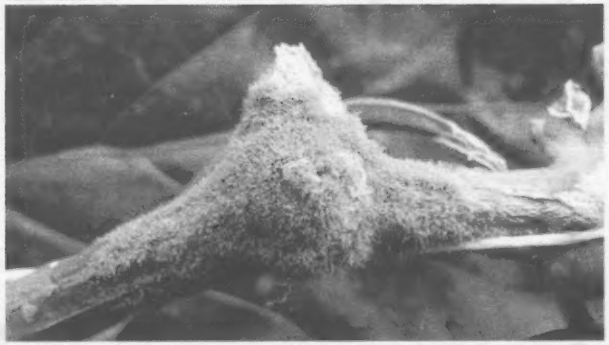
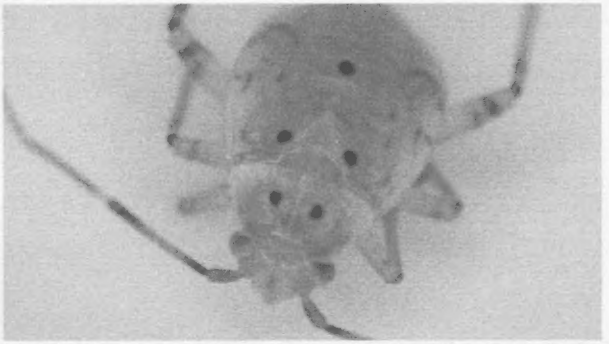
To obtain copies of this or any other OMAFRA publication, please order:

- online at ontario.ca/publications
- by phone through the ServiceOntario Contact Centre, Monday to Friday, 8:30 AM to 5:00 PM ET
  - 416-326-5300
  - 416-326-3408 (TTY)
  - 1-800-668-9938, toll-free across Canada
  - 1-800-368-7095 (TTY), toll-free across Ontario
- in person at ServiceOntario Centres across Ontario

For a major spill, a theft or a fire involving a pesticide:

Call the Ministry of the Environment and Climate Change Spills Action Centre at
1-800-268-6060 (24 hr a day, 7 days a week)
Notify your municipality.



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